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FRANK A. TAYLOR
Director, United States National Museum

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CARRIKER, M. A., JR. A revision of the genus *Furnaricola* (Mallophaga) with descriptions of new species. Thirty-three figures. No. 3532, published March 9, 1966 405–432

New species: *Furnaricola tergalis, F. lachrymosa, F. h. hirsuta, F. triangularis, F. quadraticeps, F. anabacerthia, F. longifrons, F. punensis, F. myrmeciza, F. pyriglena, F. pipraphaga, F. inexpectata.*

New subspecies: *Furnaricola certhia colombiana, F. certhia microgenitalia, F. h. hirsuta, F. h. picirostris, F. fuliginosa antioquensis, F. acutifrons chocoana, F. h. hylactipahga, F. h. canae.*

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CHEMSAK, John A. Descriptions and records of West Indian Cerambydidae (Coleoptera). No. 3526, published February 8, 1966 209–220

New genus: *Nesanoplium.*

New species: *Methia insularum, M. impressicollis, Curtomerus subflavus, Leptostylus inflaticollis, L. bredini, Urgleptes clarkei.*

New combination: *Nesanoplium puberulum.*

DUCKWORTH, W. DONALD. Neotropical Microlepidoptera, VIII: A review of the genus *Falculina* with descriptions of new species (Lepidoptera: Stenomidae). Five figures and one plate. No. 3531, published February 10, 1966 391–404

New species: *Falculina kasyi, F. bella.*

FLINT, OLIVER S., JR. Notes on certain Nearctic Trichoptera in the Museum of Comparative Zoology. Four figures. No. 3530, published February 23, 1966 373–390

New combinations: *Aphropsyche doringa, Dicosmoecus frontalis, Pycnopsyche virginica, Limnephilus costalis.*

GARRICK, J. A. F. Revision of sharks of genus *Isurus* with description of a new species. Nine figures and four plates. No. 3537, published March 15, 1967 663–690

New species: *Isurus alatus* [=*Isurus paucus* Manday].

LEWIS, ALAN G. Copepod crustaceans parasitic on Elasmobranch fishes of the Hawaiian Islands. Forty figures. No. 3524, published April 12, 1966 57–154

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OBRAZTSOV, NICHOLAS S. Neotropical Microlepidoptera, VII: New genus *Pseudomeritastis* and its species (Lepidoptera: Tortricidae). Two figures and six plates. No. 3527, published February 23, 1966 221–232

New genera: *Pseudomeritastis.*

New species: *Pseudomeritastis clarkei, P. orphnoxantha, P. distincta, P. decora.*

New combinations: *Pseudomeritastis cordigera, P. voluta, P. heliadelpha.*

OBRAZTSOV, NICHOLAS S. Neotropical Microlepidoptera, IX: Revision of genus *Pseudatteria* (Lepidoptera: Tortricidae). Twelve figures and forty-three plates. No. 3535, published December 30, 1966 577–622

New tribe: Polyorthini.

New subgenera: *Eurynatteria, Sphaeratteria.*

New species: *Pseudatteria (Pseudatteria) dognini, P. (P.) shafferi, P. (P.) pseudomaenas, P. (P.) tremewani, P. (P.) analoga, P. (P.) ardoris, P. (P.) bradleyi.*

New subspecies: *Pseudatteria (Eurynatteria) cantharopa pulchra.*

New status: Subgenus *Pseudatteria, Pseudatteria (P.) v. volcanica; P. (P.) v. rivularis, P. (Eurynatteria) c. cantharopa, P. (E.) heliocausta* f. *baccheutis.*

New combinations: *Idolatteria orgias, I. zanthocapna, Eumimographe lydia.*

PETTIBONE, MARIAN H. Revision of the Pilargidae (Annelida: Polychaeta), including descriptions of new species, and redescription of the pelagic *Podarmus ploa* Chamberlin (Polynoidae). Twenty-six figures. No. 3525, published March 31, 1966 155–208

New species: *Ancistrosyllis hartmanae, A. jonesi, Sigambra wassi.*

WILSON, MILDRED STRATTON, and TASH, JERRY C. The euryhaline copepod genus *Eurytemora* in fresh and brackish waters of Cape Tompson region, Chukchi Sea, Alaska. Three figures. No. 3534, published December 30, 1966 .. 533–576

New species: *Eurytemora arctica.*

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MARINE AMPHIPODA OF THE FAMILY AMPITHOIDAE FROM SOUTHERN CALIFORNIA

By J. LAURENS BARNARD

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Volume 118 1965 Number 3522

MARINE AMPHIPODA OF THE FAMILY AMPITHOIDAE FROM SOUTHERN CALIFORNIA

By J. Laurens Barnard
Associate Curator, Division of Crustacea

The family Ampithoidae is confined to littoral and sublittoral marine depths of the world, generally in the canopies of kelp or shallow rock bottoms where short-tufted algae grow. Being large-bodied organisms, they are among the most conspicuous amphipods. Indeed, the largest amphipod so far reported in shallow waters of southern California is *Cymadusa uncinata* (herein a specimen 35 mm. long). The world fauna supports eight genera (not including *Amphitholina*, which was transferred to the Eophliantidae by Gurjanova in 1958), but only two of these have been found in the present collections, *Ampithoe* and *Cymadusa*. A fragmentary specimen of a third genus, probably *Paragrubia*, has been found at Cayucos, Calif.

The present collections consist of materials dredged by the *Velero III* of the Hancock Foundation, especially in the channel islands off southern California, and materials of intertidal origin collected by the writer and other workers from Cayucos to La Jolla, Calif. A few samples collected by scuba diving have proved most valuable. There is a need for more extensive diving exploration of kelp holdfasts and canopies and other algal bottoms.

Ampithoids bear spinning glands in pereopods 1 and 2, which are used to form soft parchment-like tubes for inhabitation. Apparently the tubes are formed mostly among the holdfasts of kelps, smaller algae, and surfgrass. Limbaugh in a mimeographed report from Scripps Institution of Oceanography reported on an *Ampithoe* that rolls up the edge of a *Macrocystis* blade, "stitches" it along the seam, and lives in the enclosed tube. Ampithoids follow algae down to their photic limit; hence ampithoids live to greater depths in the channel islands off southern California, where the waters are clearer, than along the mainland shelf where the waters are quite turbid and algae rarely grow below 30 meters.

I am indebted to the National Science Foundation for a grant (G-10750) that supported the illustration of this work, and to the Beaudette Foundation for my support. Portions of the materials are deposited in the U.S. National Museum and the Allan Hancock Foundation, University of Southern California.

Key to Species of World *Ampithoe*

1. Third pleonal epimeron with a point at the lower posterior corner . . . 2
   Third pleonal epimeron rounded at lower posterior corner 4
2. Male gnathopod 1: fifth article 1.8 times as long as article 6.
   tarasovi (check *mitsukurii* also)
   Male gnathopod 1: fifth article subequal to or shorter than article 6 . 3
3. Flagellum of antenna 1 shorter than flagellum of antenna 2 . **australiensis**
   Flagellum of antenna 1 almost twice as long as flagellum of antenna 2.
   lacertosa (=**scitula**)
4. Gnathopod 1: palm distinctly transverse, short, corner sharply quadrate, article 6 linear, posterior edge straight, article 7 greatly overlapping palm (fig. 1*a*) 5
   Gnathopod 1: palm, if present, oblique 14
5. Flagellum of second antenna 2–4 articulate or very stout (fig. 1*n*) . . . 6
   Flagellum of second antenna slender or more than 8-articulate (fig. 1*m*) . 8
6. Article 2 of pereopods 3–5 quite narrow, linear . . . . . **plea**
   Article 2 of pereopods 3–5 broad, biconvex 7
7. Lobe of article 5 on male gnathopod 2 acute . . **brevipes** (of Bate 1862)
   Lobe of article 5 on male gnathopod 2 obtuse but narrow . . . . **lindbergi**
8. Male gnathopod 2 similar to gnathopod 1 . . . . . **humeralis**
   Male gnathopod 2 much larger than gnathopod 1 9
9. Palm of male gnathopod 2 minutely and irregularly serrate its full length . . . . . **annenkovae**
   Palm of male gnathopod 2 not serrate for its full length.
   femorata, brevipes, falsa, orientalis, and those of couplet 10
10. Gnathopod 1: article 6 extremely slender (fig. 1*a*).
    orientalis (of J. L. Barnard 1955)
    Gnathopod 1: article 6 moderately stout 11
11. Female gnathopod 2: palm transverse 12
    Female gnathopod 2: palm oblique 13

12. Article 4 of antenna 2 shorter than article 5 . species of southern California
Article 4 of antenna 2 as long as or longer than article 5 . **tea**, new species
13. Pereopod 5: article 5 twice as broad as article 6, subequal to 6 in length . . . . . **eoa**
Pereopod 5: article 5 not broader but much shorter than article 6 . . . **mea**
14. Male gnathopod 2 with tooth defining palm 15
Male gnathopod 2 lacking palmar defining tooth 18
15. Palm of gnathopod 2 transverse, bearing bilobed tubercle in middle of palm . . . . . **mitsukurii** (see also *valida*)
Palm of gnathopod 2 oblique, or with long hind tooth 16
16. Distal lobules of lower lip equal in size . . . . . **pollex** and **volki**
Lateral distal lobules of lower lip much longer than medial lobules . . . 17
17. Article 6 of male gnathopod 2 not produced anterodistally. **simulans** (=**dalli**), **kussakini**
Article 6 of male gnathopod 2 produced into a setose lobe anterodistally **ramondi**
18. Male antenna 2 with dense tufts of setae 19
Male antenna 2 lacking dense tufts of setae 23
19. Male gnathopod 2: hind margin of article 6 and palm equal in length . . 20
Male gnathopod 2: hind margin of article 6 much longer than palm . . 21
20. Article 5 of gnathopod 1 shorter than article 6 . . . . . **alluaudi**
Article 5 of gnathopod 1 much longer than article 6. **brasiliensis** (of Oliveira 1953)
21. Dense setal tufts of antenna 2 confined to article 5 of peduncle and flagellum . . . . . **plumulosa**
Dense setal tufts of antenna 2 borne on articles 4–5 of peduncle and flagellum 22
22. Finger of gnathopod 1 matching palm . . . . . **brasiliensis** and **africana**
Finger of gnathopod 1 overlapping palm . . . . . **zachsi**
23. Palm of male gnathopod 2 with a process (not defining) 24
Palm of male gnathopod 2 lacking a process 26
24. Palm of male gnathopod 2 transverse . . . . . **valida** (see also *mitsukurii*)
Palm of male gnathopod 2 oblique 25
25. Palm of male gnathopod 2 equal to hind margin of article 6 . . . **grubiformis**
Palm of male gnathopod 2 much shorter than hind margin of article 6. **senegalensis**
26. Palm of male gnathopod 1 moderately excavate (fig. 1*e*) 27
Palm of male gnathopod 1 not excavate 30
27. Hind lobe of article 5 on gnathopod 1 truncated 29
Hind lobe of article 5 on gnathopod 1 rounded 28
28. Male gnathopod 2: article 6 half as wide as long, flagellum of antenna 1 twice as long as flagellum of antenna 2 . . . . . **rubricata**
Male gnathopod 2: article 6 three-fourths as wide as long, flagellum of antennae 1–2 subequal in length . . . . . **rubricatoides**
29. Article 5 of gnathopod 1 nearly as long as article 6 . . **djankonovi** (in part)
Article 5 of gnathopod 1 half as long as article 6 . . . . . **marcuzzii**
30. Palm of male gnathopod 2 transverse . . . . . **japonica** (in part)
Palm of male gnathopod oblique 31
31. Distal lobules of lower lip equal in size (fig. 1*l*) . . . . . **japonica** (in part)
Distolateral lobules of lower lip much larger than medial lobules (fig. 1*j*) . 32

32. Palm of male gnathopod 1 short, scarcely evident, finger overlapping pal considerably, article 6 linear (fig. 1*d*) . . . . . **longima**
Palm of male gnathopod distinct, long, finger matching palm, article suboval (fig. 1*c*) . . . . . **djankonovi** (in par

Not included in the key are *A. kergueleni* Stebbing (1888), a female but see Chevreux (1927) for a possibly correct assignment of a male *A. megaloprotopus* Stebbing (1895), which probably belongs in the genus *Exampithoe* because of its enlarged first gnathopod.

Notes on the Literature of *Ampithoe*

The genus *Ampithoe* and many of its species are nomenclaturally quite old. Several species have been based on females or juveniles and this early confusion still has not been straightened out.

The most important and involved situation is that concerning *Ampithoe femorata* Krøyer and *A. brevipes* Dana. Stebbing (1906), without new material, recognized both species but noted their close affinities. By evidence of his synonymies, he considered *A. gaudichaudii* Milne Edwards a senior synonym of *A. femorata*, and he included questionably in *A. brevipes* the species *A. peregrina* Dana and *A. falklandi* Bate. These species are scattered widely in the Southern Hemisphere on both sides of South America. Chilton (1921) also reported *A. femorata* from the Juan Fernandez Islands.

Schellenberg (1931) combined *femorata* and *brevipes* and their synonyms, including K. H. Barnard's (1916) reference to *brevipes*. K. H. Barnard (1932) gave a new name, *falsa*, to his 1916 *brevipes* identification from South Africa, but reported on *brevipes* from the Falkland Islands and mentioned *A. chilensis* as a possible synonym. Stephensen (1949) reported *brevipes* from Tristan da Cunha (again) noting the characteristic swelling of article 4 of pereopods 1–2. J. L. Barnard (1952) erroneously identified *femorata* from California. In retrospect, I relied upon Bate's (1862) figure of *brevipes* (pl. 43, fig. 2) showing the short flagellum of antenna 2. My identification should be referred to *A. lindbergi*. The early drawings and descriptions of *brevipes*, *falklandi*, *peregrina*, *gaudichaudii*, and *chilensis* leave much to be desired in comparison to the better described *A. femorata*. The gnathopods of the supposedly female *falklandi* are rather stouter than expected for *brevipes*, and the fifth article has a posterior lobe. I strongly question that *falklandi* is a synonym of *brevipes*, as figured in the literature, although *falklandi* seems to fit *brevipes* as to be expected of a female. There are discrepancies in the stoutness of article 4 of pereopods 1–2 in the various figures of Bate (1862). Considering the situation in California of several Ampithoes such as *humeralis*, *lindbergi*, *mea*, *tea*, and *plea*, all very difficult to separate in female, juvenile, and

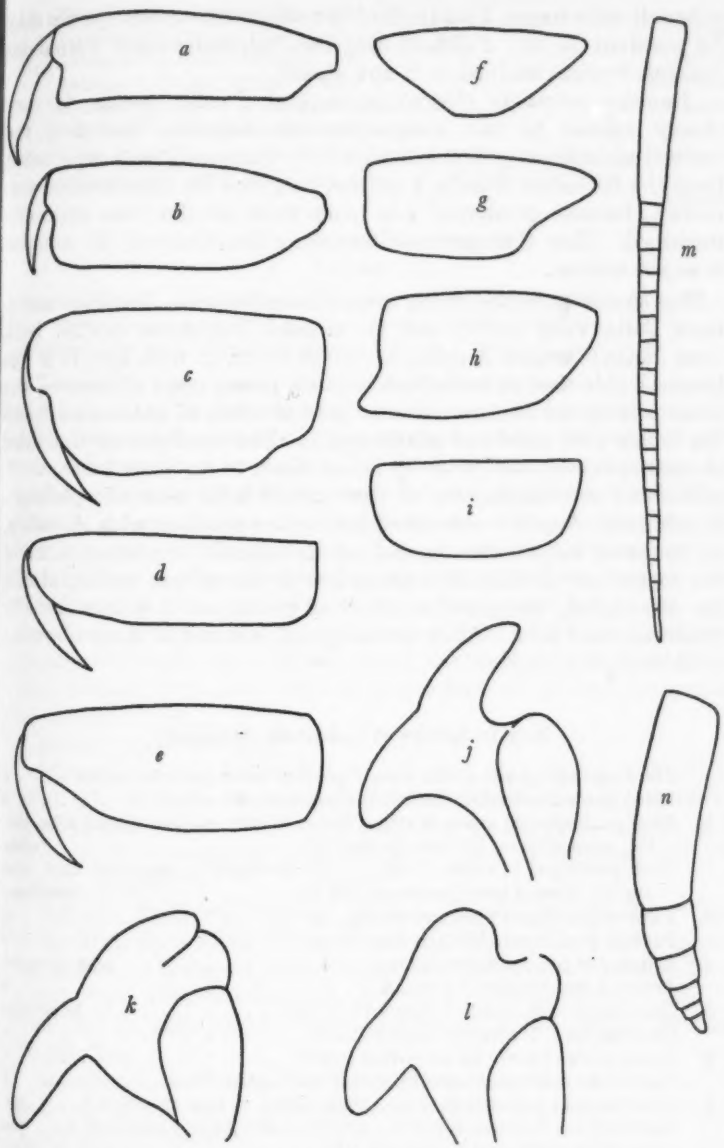

FIGURE 1.—Schematic diagrams of gnathopods, lower lips, and second antennae as represented in keys of *Ampithoe: a–e*, articles 6–7 of first gnathopods; *f–i*, article 5 of first gnathopods; *j–l*, lower lips (halves); *m*, *n*, second antennae.

subadult male stages, I am inclined to believe that several species may be involved in the Falkland-Magellan-Valparaiso-Juan Fernandez *femorata-brevipes* complex as it now stands.

Ampithoe orientalis (Dana), a tropical Pacific species, is very closely related to the *brevipes-femorata* complex, including the *eoa-mea-annenkovae* group; although J. L. Barnard (1955) reported it from the Hawaiian Islands, I am not sure that his identification was correct, because gnathopod 1 is much more slender than originally described. How that species differs from the others of the complex is as yet unclear.

One should note the strong resemblance between *Ampithoe mitsukurii* Della Valle (1893) and *A. tarasovi* Bulycheva (1952), both from Japan; because Ampithoes change so much with age, it is not inconceivable that *A. mitsukurii* is but a young stage of *tarasovi*, the latter having the broader, blunter palmar tooth of gnathopod 2 and the longer fifth article of gnathopod 1. The condition of the third pleonal epimeron and lower lip is not clear, to my knowledge, in *A. mitsukurii* and clarification of these would help solve the problem. In addition, *Ampithoe mitsukurii* bears close checking with *A. valida*, for the latter has a narrow medial palmar tubercle on gnathopod 2 and the suggestion at times of a projection at the palmar corner; also it has the slightly elongated article 5 of gnathopod 1 with a distally produced hind lobe. Most probably, *A. mitsukurii* is an aberrant individual of *A. valida*.

Key to Species of California *Ampithoe*

1. Third pleonal epimeron with a small point at lower posterior corner . . 2
   Third pleonal epimeron rounded at lower posterior corner 3
2. Male gnathopod 1: article 5 with a large, distally produced hind lobe (fig. 1*h*), lobes of lower lip bulbous (fig. 1*k*) . . . . . **valida**
   Male gnathopod 1; article 5 with poorly developed unproduced hind lobe (fig. 1*f*), lobes of lower lip slender (fig. 1*j*) . . . . . **lacertosa**
3. Palm of gnathopod 1 transverse (figs. 1*a*, *b*) 4
   Palm of gnathopod 1 oblique (figs. 1*c–e*) 9
4. Article 2 of pereopods 3–5 narrow . . . . . **plea** (in part)
   Article 2 of pereopods 3–5 broad 5
5. Gnathopods 1–2: article 5 equals 6 in length . . . . . **humeralis**
   Gnathopods 1–2: article 5 shorter than 6 6
6. Apical lobes of lower lip projecting equally 8
   Apical lateral lobes of lower lip longer than medial lobes 7
7. Male antenna 2: peduncle stout, article 4 90% as long as article 5 . . **sp.**
   Male antenna 2: peduncle slender, article 4 120% as long as article 5 . . **tea**
8. Article 6 of gnathopod 1 stout (fig. 1*b*) . . . . . **plea** (in part)
   Article 6 of gnathopod 1 slender (fig. 1*a*) . . . . . **lindbergi**
9. Lobe on article 5 of gnathopod 1 distally produced 10
   Lobe on article 5 of gnathopod 1 rounded behind (figs. 1*f*, *g*, *i*) 12

10. Lobules of lower lip slender, separated 11
Lobules of lower lip stout, appressed (fig. 1*k*) . . . . . **valida**
11. Antenna 2 normally setose in male . . . . . **ramondi**
Antenna 2 strongly setose in male . . . . . **plumulosa**
12. Lobules of lower lip bulbous and appressed (fig. 1*k*) . . . . . **pollex**
Lobules of lower lip slender and separated 13
13. Palm of gnathopod 1 obsolescent, article 5 as long as 6 (fig. 1*d*) . **longimana**
Palm of gnathopod 1 distinct, article 5 much shorter than 6 (fig. 1*e*). **simulans**

Ampithoe humeralis Stimpson

FIGURES 2–3

Amphithoe [sic] *humeralis* Stimpson, 1864, p. 156.—Calman, 1898, pp. 271–273, pl. 33, fig. 4.—Holmes. 1904, p. 241.—Hewatt, 1946, pp. 199, 204.
Ampithoe humeralis.—Stebbing, 1906, p. 636—J. L. Barnard, 1954, p. 29.

Diagnosis: Second and third pleonal epimera rounded behind, with slight lateral ridges; article 5 of male gnathopod 1 longer than article 6, hind edge truncated, not lobate, article 6 rectangular, slender, palm transverse or slightly chelate, finger overlapping palm by its full length; gnathopod 2 like gnathopod 1 except article 5 is slightly shorter, although longer than article 6, and with a distinct, rounded hind lobe; article 6 like that of gnathopod 1; article 2 of pereopods 1–2 about 1.7 times as long as broad; ventral edge of article 1 on antenna 1 lacking ventral spines; antenna 1 much longer than antenna 2, flagellum about four times as long as flagellum of antenna 2, neither flagellum strongly setose; lateral apical lobule of lower lip much longer than medial lobule, coxa 1 not produced forward; peduncular process or uropod 1 long.

Female: Like the male.

Material: *Velero* stations 1206 (7), 1409 (5), 1489 (1), 2052 (1), 4806 (2), 4822 (2). Barnard stations 33 (1), 42–C–7 (1). Oceanographic Lab., Friday Harbor, Wash., Aug. 16–29, 1949, coll. Dr. J. L. Mohr (13). Guadalupe Island, Dec. 9, 1946, 26–29 fms., coll. Dr. Carl L. Hubbs (1).

Records: Intertidal: Friday Harbor, Wash.; North Bay, Cape Arago State Park, Oreg.; Hazard Reef, S. of Morro Bay, Calif. Islands off southern California: San Nicolas 4–9 fms.; Santa Barbara, 26–39 fms. Point Conception, Calif., 8–9 fms.; off Long Beach, Calif., 13 fms.; Off La Jolla, Calif., 1 fm. Guadalupe Island, Baja California, 26–29 fms.

Relationship: This species is unique in *Ampithoe* for having the male and female gnathopods identical, the male gnathopod 2 being as small as gnathopod 1.

Young males and females are difficult to separate from *A. plea*, *A. lindbergi*, *A. mea*, and *A. tea*.

Distribution: Puget Sound to Guadalupe Island.

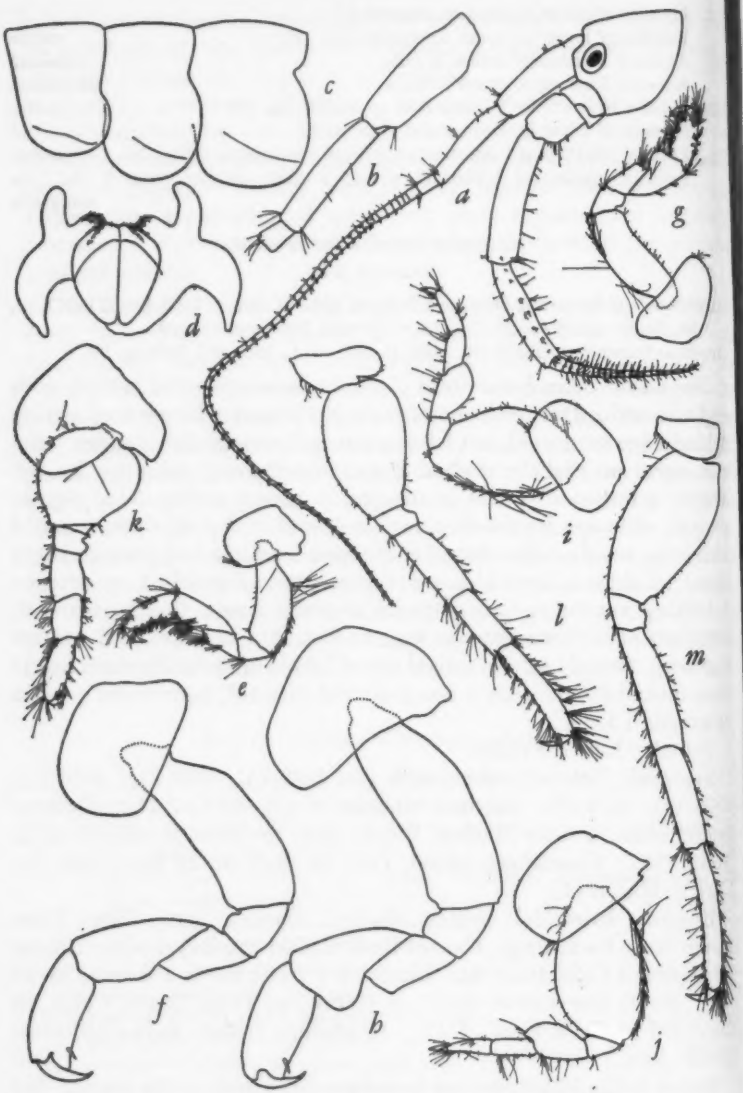

FIGURE 2.—*Ampithoe humeralis* Stimpson, male, 22 mm., sta. 1206: *a*, head; *b*, peduncle of antenna 1; *c*. metasome; *d*, lower lip; *e*, *f*, gnathopod 1; *g*, *h*, gnathopod 2; *i*–*m*, pereopods 1, 2, 3, 4, 5.

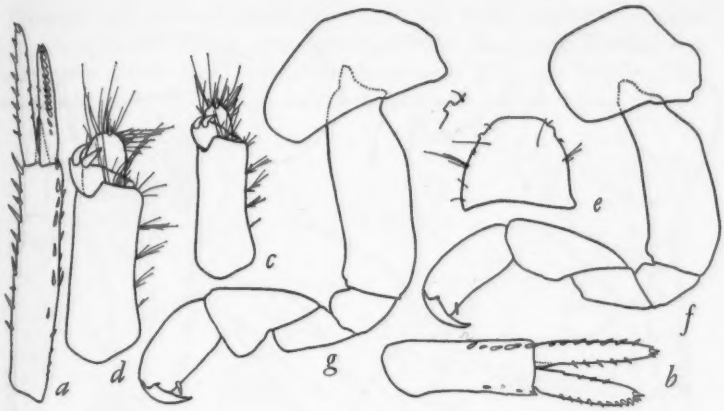

FIGURE 3.—*Ampithoe humeralis* Stimpson, male, 22 mm., sta. 1206: *a–d*, uropods 1, 2, 3, 3; *e*, telson; female, 19 mm.: *f*, *g*, gnathopods 1, 2.

Ampithoe lacertosa Bate

FIGURES 4–5

Amphithoë [sic] *lacertosa* Bate, 1858, p. 362; 1862, pp. 236–237, pl. 41, fig. 5.
Ampithoe lacertosa.—Stebbing, 1906, pp. 633–634.—J. L. Barnard, 1954, pp. 31–33, pls. 29–30.—Nagata, 1960, pp. 175–176, pl. 16, figs. 95–96.
Amphithoë macrurus Stephensen, 1944, pp. 80–83, figs. 30–31.
Dexamine scitulus Harford, 1877, p. 116.
Amphithoë scitulus Holmes, 1904, pp. 314–315, pl. 36, figs. 21–24.
?*Amphithoë Stimpsoni* Boeck, 1871, pp. 14–15, fig. 5.

Diagnosis: Second and third pleonal epimera with a point at the lower posterior corners; articles 5 and 6 of male gnathopod 1 subequal in length, posterior edge of article 5 formed of a broad, flat lobe bluntly projecting distally, palm oblique; male gnathopod 2 with large rounded lobes on articles 2 and 3, article 5 with an intermediate-sized hind lobe, article 6 greatly elongated, subrectangular, palm transverse, slightly sinuous, slightly cheliform, dactylus stout, fitting palm, apically blunt; article 2 of pereopods 1–2 about 2.2 times as long as broad; ventral edge of article 1 of antenna 1 with several spines; antenna 1 reaching farther than antenna 2, its flagellum about twice as long as flagellum of antenna 2, both flagella poorly setose, but long and with numerous articles; outer apical lobule of lower lip twice as long as inner lobule, peduncle of uropod 3 elongated; peduncular process of uropod 1 poorly developed.

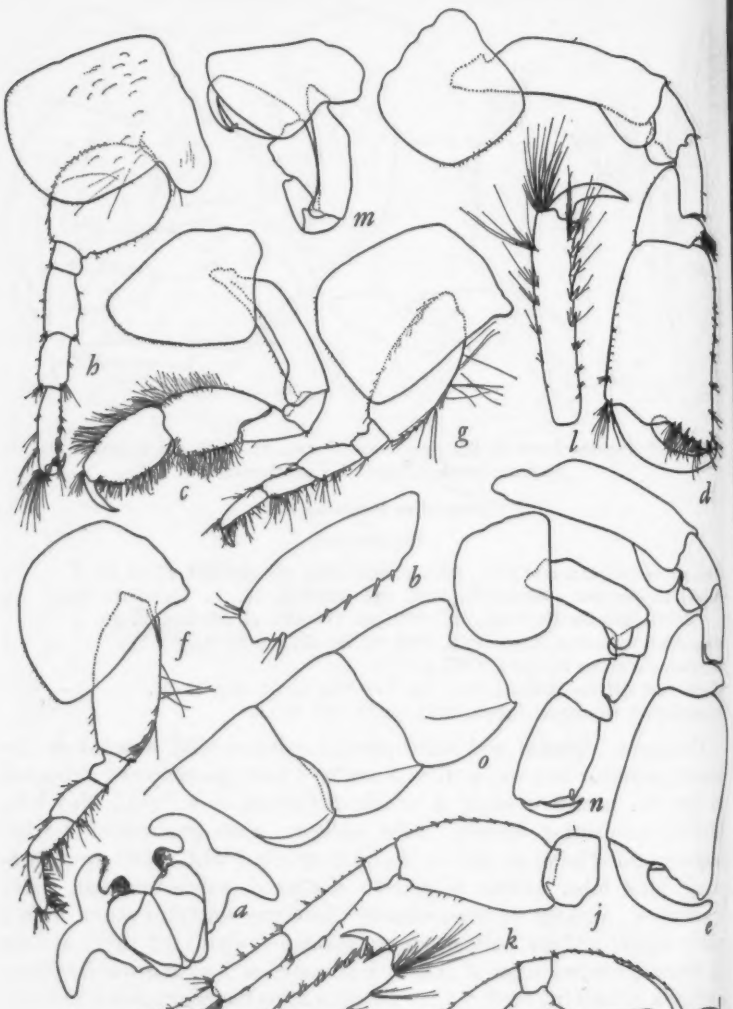

FIGURE 4.—*Ampithoe lacertosa* Bate, male, 22 mm., sta. 1455: *a*, lower lip; *b*, article 1 of antenna 1; *c*, gnathopod 1; *d*, *e*, gnathopod 2; *f–j*, pereopods 1, 2, 3, 4, 5; *k*, *l*, ends of pereopods 3, 5; *o*, metasome; male, 11 mm., Barnard sta. 33: *m*, *n*, gnathopods 1, 2.

Females: Article 5 of gnathopod 1 ranging from shorter to longer than article 6 (the latter, see Nagata, 1960), the larger the female, the longer is article 5. Hence, the gnathopods of young females may be confused with those of *A. valida* and indeed are like those figured

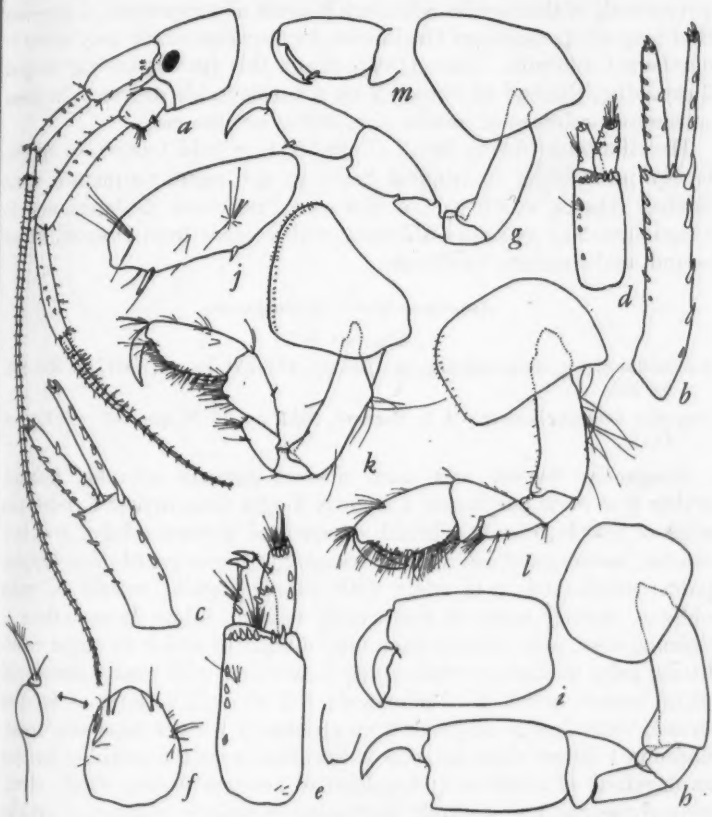

FIGURE 5.—*Ampithoe lacertosa* Bate, male, 22 mm., sta. 1455: *a*, head; *b–e*, uropods 1, 2, 3, 3; *f*, telson; male, 15 mm., Barnard sta. 33: *g–i* gnathopods 1, 2, 2; female, 12.5 mm., Barnard sta. 33: *j*, article 1 of antenna 1; *k–m*, gnathopods 1, 2, 2.

by Nagata for *A. valida*. Gnathopod 2 with article 5 like the male article 5 of gnathopod 2; article 6 a slightly stouter version of the same article in gnathopod 1.

Material: *Velero* stations 1455 (1), 1646 (1). Barnard station 33 (12).

Records: California: Pacific Grove, intertidal; Santa Catalina Island, intertidal; La Jolla, 1 fm.

Remarks: *Dexamine scitulus* Harford, the type of which was refigured by Holmes (1904), apparently is a female of this species.

The most important clues are the lengths of the antennal flagella and the produced points of the second and third pleonal epimera, unique to this species.

Possibly *A. stimpsoni* Boeck, from San Francisco, represents a young male of this species, although it could also represent *A. japonica* Stebbing or *A. djakonovi* Gurjanova, two species which may occur in northern California. Bate (1862) shows this species having uropod 3 exceeding the end of uropod 2 by a considerable degree. In these southern specimens of smaller size, this is not the case.

Distribution: "Arctic Seas" (Bate 1862), a cold temperate species barely penetrating to tropical limits in the warm temperate, from Kodiak Alaska, south to the Shizueka Prefecture in Japan and to Magdalena Bay in Baja California, with records from Oregon, Puget Sound, and southern California.

Ampithoe lindbergi Gurjanova

FIGURES 6–7

Amphithoe [sic] *lindbergi* Gurjanova, 1938, pp. 351–354, fig. 49; 1951, pp. 892–895, fig. 620.

Ampithoe femorata Krøyer.—J. L. Barnard, 1952, pp. 24–28, pls. 6–7 (not Krøyer, 1845).

Diagnosis: Second and third pleonal epimera rounded behind; article 6 of male gnathopod 1 slightly longer than article 5, posterior edge of article 5 with a broadly truncated posterior lobe, article 6 slender, rectangular, palm short, transverse, finger greatly overlapping palm; gnathopod 2 of male with subrectangular article 6, palm oblique, slightly concave, but clearly defined, minutely crenulate at defining area, palm shorter than hind margin of article 6, finger short, fitting palm or slightly overlapping it, article 2 with poorly developed distal bump; article 2 of pereopods 1–2 about 2.0 times as long as broad; ventral edge of article 1 on antenna 1 with at least one spine; antenna 1 longer than antenna 2, flagellum nearly four times as long as flagellum of antenna 2; flagellum of antenna 2 very short, stout, strongly setose, progressively decreasing in male in number of articles from about 6 to 3; apical lobules of lower lip short, subequal in length; coxa 1 not produced forward; peduncular process of uropod 1 long.

Female: Gnathopod 1 similar to that of male, article 5 slightly shorter; gnathopod 2 like gnathopod 1 but article 5 even shorter and with moderately well-developed, but rather stout hind lobe; antenna 2 generally with 1–3 more flagellar articles than in male.

Material: *Velero* station 1664 (15). Barnard stations 27 (3), 42-T-5 (1 juv.?), 42–T–6 (2), 42–T–7 (1), 42–C–7 (2), 43–B–3 (2). Point Fermin, Calif., Jan. 14, 1949, coll. Dr. J. L. Mohr (2).

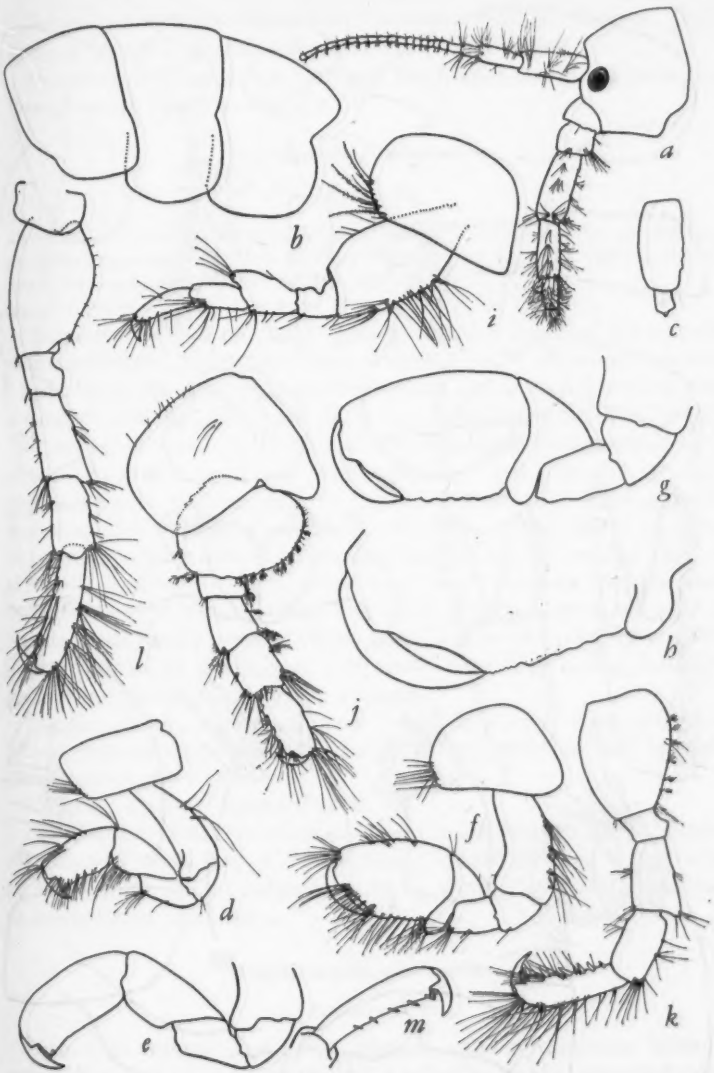

FIGURE 6.—*Ampithoe lindbergi* Gurjanova, male, 12.0 mm., sta. 1664: *a*, head; *b*, metasome; *c*, flagellum of antenna 2; *d*, *e*, gnathopod 1; *f*–*h*, gnathopod 2; *i*–*l*, pereopods 1, 3, 4, 5; *m*, end of pereopod 5.

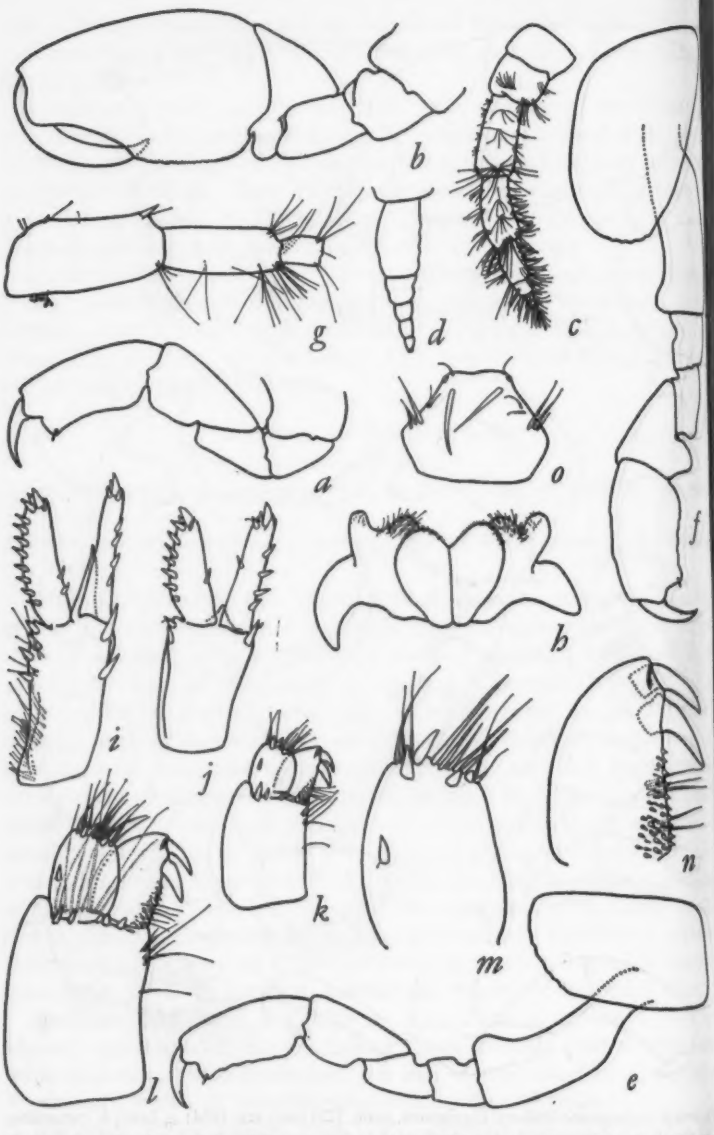

FIGURE 7.—*Ampithoe lindbergi* Gurjanova, station 1664: *a*, *b*, gnathopods 1, 2, male, 11.5 mm.; *c*–*g*, female, 9.0 mm.: *c*, antenna 2; *d*, flagellum of antenna 2; *e*, *f*, gnathopods 1, 2; *g*, peduncle of antenna 1; *h*–*o*, male, 12.0 mm.: *h*, lower lip; *i*–*l*, uropods 1, 2, 3, 3; *m*, *n*, inner and outer rami of uropod 3; *o*, telson.

Records: California intertidal: Cayucos; Hazard Canyon Reef, south of Morro Bay; Point Fermin; Santa Cruz Island.

Distribution: Bering Sea, Okhotsk Sea, Japan Sea to California at Point Fermin, near Los Angeles.

Ampithoe longimana Smith

FIGURE 8

Amphithoë [sic] *longimana* Smith, 1873, pp. 563–564.—Holmes, 1905, p. 509, fig.
Amphithoe longimana.—Kunkel, 1910, pp. 87–90, fig. 34; 1918, pp. 147–149, fig. 43.
Amphithoë longimana.—Pearse, 1912, p. 376.
Ampithoe longimana.—J. L. Barnard, 1959, pp. 36–37, pl. 12.

Diagnosis: Second and third pleonal epimera rounded behind and at lower corners, no lateral ridges; articles 5 and 6 of male gnathopod 1 equal in length, slender, palm obsolescent, finger greatly overlapping the end of article 6, hind edge of article 5 shallow, not lobed, broad, flat; male gnathopod 2 rather small, scarcely larger than gnathopod 1, article 5 shorter than 6 and with subacute hind lobe not strongly projecting, palm oblique, sinuous, sharply defined, finger fitting palm; second articles of both gnathopods with anterodistal lobes; article 2 of pereopods 1–2 about 2.5 times as long as broad; ventral edge of article 1 on antenna 1 with one or two spines; antenna 1 longer than 2, flagellum of antenna 1 about 3 times as long as that of antenna 2, flagella both poorly setose, outer apical lobule of lower lip slightly longer than inner lobule, not appressed; coxa 1 produced forward; peduncular process of uropod 1 vestigial.

Female: Article 5 of gnathopod 1 slightly shorter than article 6, palm better developed than in male; gnathopod 2 like that of male but articles 5 and 6 shorter.

Material: Same as Barnard 1959.

Distribution: Atlantic coast of the United States, from Massachusetts to Florida Bay, Fla.; Bermuda; Pacific America from Bahía de San Quintín, Baja California north to Morro Bay, Calif., confined to embayments and lagoons.

Ampithoe plea, new species

FIGURES 9, 10

Diagnosis: Second and third pleonal epimera rounded behind; articles 5 and 6 of male gnathopod 1 equal in length, posterior edge of article 5 with a truncate, rather broad lobe, article 6 rectangular but not very slender, palm well developed, slightly oblique, well defined, finger scarcely overlapping palm; gnathopod 2 in terminal male with article 6 greatly elongated, the full hind margin representing the palm, with a blunt process near the finger hinge, article 7 long,

curved, reaching to end of palm or the full length of article 6, article 2 with poorly developed distal bump; article 2 of pereopods 1 and 2 about 2.0 times as long as broad; ventral edge of article 1 on antenna

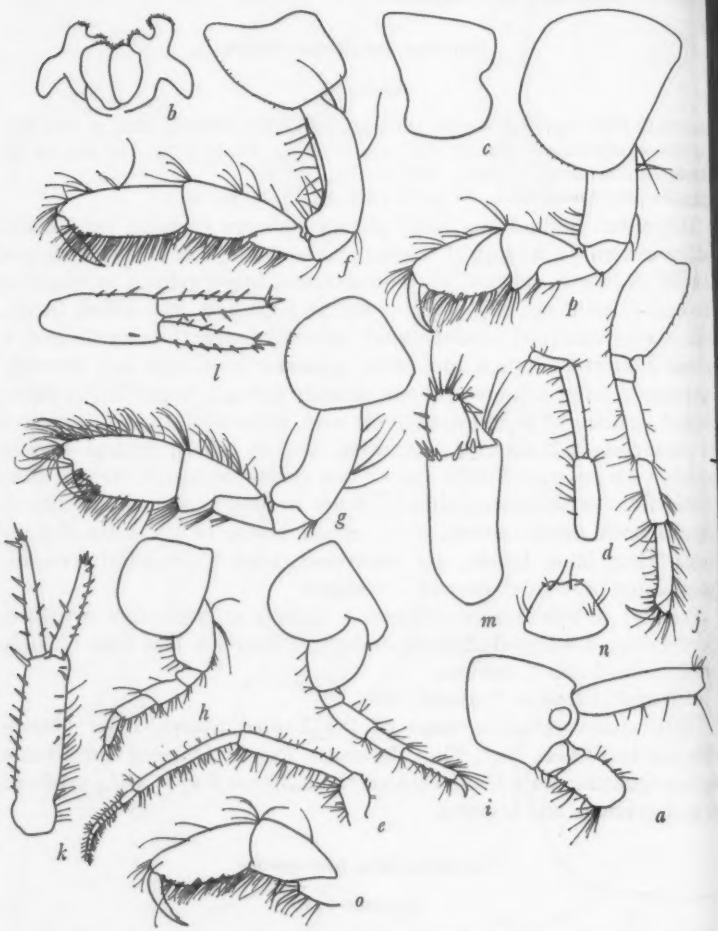

FIGURE 8.—*Ampithoe longimana* Smith, male, 9.0 mm., Newport Bay, Calif. (redrawn after Barnard 1959): *a*, head; *b*, lower lip; *c*, pleonal segment 3; *d*, *e*, parts of antennae 1, 2; *f*, *g*, gnathopods 1, 2; *h–j*, pereopods 2, 3, 5; *k–m*, uropods 1, 2, 3; *n*, telson; female, 9.0 mm.: *o*, *p*, gnathopods 1, 2.

1 with a few distal setae; antenna 1 somewhat longer than antenna 2, flagellum four times as long as that of antenna 2; flagellum of antenna 2 very short, stout, about 8-articulate, article 1 of flagellum

especially stout but elongated, conspicuously setose; lateral apical lobule of lower lip projecting more than medial lobule; coxa 1 not produced forward; peduncular process of uropod 1 long.

Female: Flagellum of antenna 2 slender; gnathopod 1 like male but article 5 slightly shorter than 6, article 6 slightly more slender,

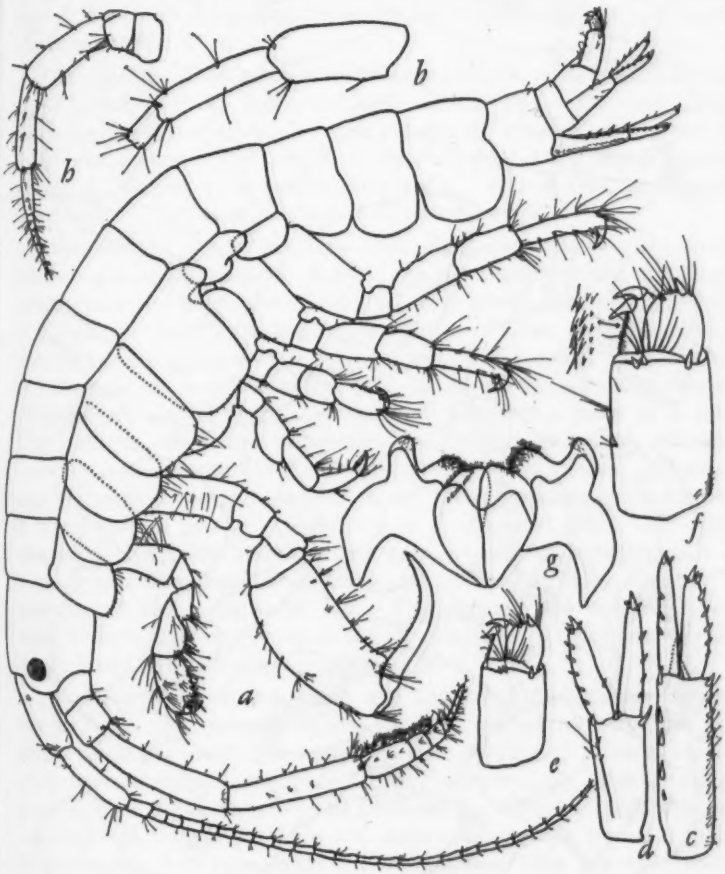

FIGURE 9.—*Ampithoe plea*, new species, holotype, male, 8.5 mm., sta. 4806: *a*, lateral view; *b*, peduncle of antenna 1; *c–f*, uropods 1, 2, 3, 3; *g*, lower lip; female, 7.5 mm.: *h*, antenna 2.

palm shorter and finger shorter; gnathopod 2 like gnathopod 1 but article 5 short, with moderately better developed hind lobe, articles 6 and 7 slightly stouter than in gnathopod 1; article 2 of both gnathopods with posterodistal edge serrate and strongly setose.

Young male: Gnathopod 2 with shorter finger, process of palm scarcely developed. Apparently with age some second antennal flagellar segments are lost because the young male here has 10 flagellar articles and the terminal male only 8.

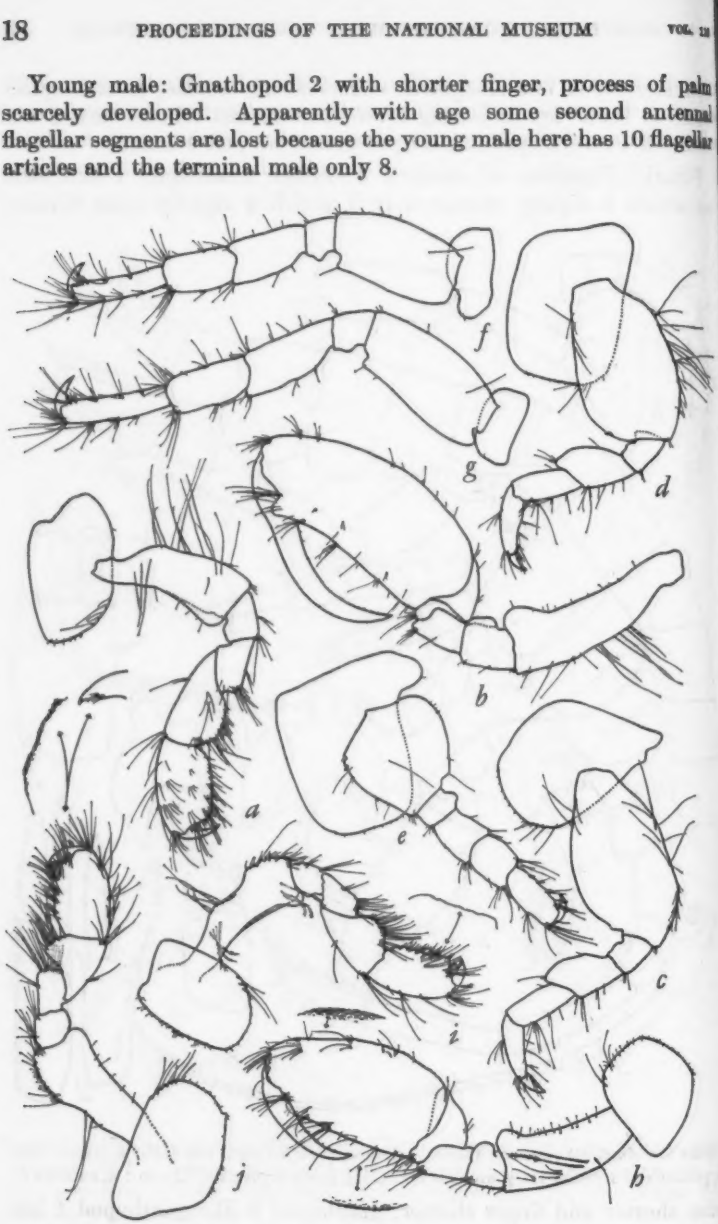

FIGURE 10.—*Ampithoe plea*, new species, holotype, male, 8.5 mm., sta. 4806: *a*, *b*, gnathopods 1, 2; *c–g*, pereopods 1, 2, 3, 4, 5; young male, 4.5 mm.: *h*, gnathopod 2; female, 7.5 mm.: *i*, *j*, gnathopods 1, 2.

Holotype: Allan Hancock Foundation No. 5737, male, 8.5 mm.

Type locality: *Velero* station 4806, Palos Verdes Headland, Los Angeles Co., Calif., 33–44–13 N., 118–23–08 W., 8 fms., Jan. 6, 1957.

Material: *Velero* stations 4806 (8), 4823 (1 juv.?) 4956 (1). Campbell station 5 (juv. 1?).

Records: Near Coal Oil Point, Calif., 8 fms.; Goleta, living in holdfast of *Macrocystis pyrifera;* Palos Verdes Headland, Calif.; off Santa Barbara, Calif., 17 m.

Relationship: This species is closely related to *A. orientalis* Dana, as reviewed by J. L. Barnard (1955) but differs by the very short, stout male second antennal flagellum and by gnathopod 1 which is much stouter, especially article 6, its palm well developed and with article 7 scarcely overlapping the palm. The second articles of pereopods 1–5 are more slender in the new species.

Ampithoe mea Gurjanova (see 1951) is another relative, but again its first gnathopod is more slender, the palm shorter, and the finger overlapping the palm more strongly. The second antennal flagellum of *A. mea,* although tending to be short and stout, has 22 articles. The first antenna has a stout spine on peduncular article 1. Probably *A. mea* and *A. eoa* Gurjanova (see 1951) are synonomous despite Gurjanova's careful analysis of their differences in a table on p. 885. For instance, her figure of pereopod 3 (fig. 616) is indeed pereopod 2 and so is not comparable to the third pereopod of *A. eoa. Ampithoe mea* is simply a younger stage of *A. eoa,* the male finger on gnathopod 2 being shorter (see *A. orientalis* in J. L. Barnard [1955] and other species of *Ampithoe* herein, where the gnathopodal development is traced) and the disparity in thickness between articles 5 and 6 of pereopod 5 increasing with age. The present new species differs from both *A. mea* and *A. eoa* in the development of a process near the finger hinge in adult male gnathopod 2.

Ampithoe lindbergi Gurjanova (see 1951) is a distinct species also available in the present collections. Its second antenna has the short thick flagellum, but again its first gnathopod is very slender with the strongly overlapping finger; however, one might imagine that its second gnathopod could develop into that of *A. plea* with advancing age. Perhaps there are differences in the second articles of pereopods 3–5 because in the new species they are abnormally slender; they have not been described for the types of *A. lindbergi.*

Ampithoe annenkovae Gurjanova (see 1951) is another species with the long palm and finger of male gnathopod 2. Its second antennal flagellum is slender although only 9-articulate and perhaps the antenna shown is for the female. If so, and the male antenna had been broken, it would be conceivable that *A. annenkovae* males are

simply terminations of those of *A. lindbergi*. The male palmar border of gnathopod 2 in *A. annenkovae* is furnished irregularly with serrate bumps. The female gnathopod 2 of *A. annenkovae* is remarkably like the male second gnathopod of *A. lindbergi*.

Distribution: Southern California.

Ampithoe plumulosa Shoemaker

Figures 11, 12

Ampithoe plumulosa Shoemaker, 1938, pp. 16–19, fig. 1; 1942, p. 39.—J. L. Barnard, 1959, p. 37.

Diagnosis of male: Second and third pleonal epimera rounded behind and at lower corners, no lateral ridges; article 5 of gnathopod 1 shorter than 6, hind edge with a truncated lobe, acutely, but slightly, projecting distally, palm obsolescent; gnathopod 2 with elongated rectangular article 6, palm oblique, sinuous, palmar corner well defined, finger stout, curved, fitting palm, article 5 with narrow subacute hind lobe; second articles of both gnathopods with rounded anterodistal lobes, aberrantly acute in gnathopod 2 (fig. 11*i*); article 2 of pereopods 1–2 about 2.4 times as long as broad; ventral edge of article 1 of antenna 1 spiniferous; antenna 1 longer than 2, its flagellum much longer than that of antenna 2, flagellum of antenna 2 scarcely longer than article 5 of peduncle but more than 20-articulate, flagellum and article 5 of peduncle densely setose; outer apical lobules of lower lip slender and much longer than medial lobules; coxa 1 produced forward; peduncular process of uropod 1 vestigial.

Female: Gnathopod 2 with a more oblique, but less sinuous palm than in male, hind lobe of article 5 more obtuse.

Material: *Velero* stations 878 (1), 1041 (1), 1221 (7), 1440 (1), 1449 (40), 1508 (1), 1509 (4), 2000 (1), 2066 (2), 2080 (19), 4822 (2), 4852 (1), 5364 (3), 5564 (2). Barnard stations 33 (5), 36 (3), 37 (45). Glorietta Bay, San Diego Bay, Mar. 19, 1950, coll. Dr. J. L. Mohr (15); Dana Point, Calif., Jan. 25, 1948, in *Phyllospadix*, coll. Dr. J. L. Mohr (3). Black Warrior Lagoon, Baja California, Mar. 21, 1956, coll. Drs. J. Soule and W. K. Emerson, station 336 (1).

Records: California intertidal at Santa Catalina Island, Newport Bay, Corona del Mar. Baja California intertidal at Punta Eugenia, 20 miles east of Punta Eugenia, Punta Santa Rosalía, Millers Landing on "west" side of Bahia Sebastian Viscaino. Cedros Island on *Phyllospadix*. California subintertidal: near Point Conception 9 fms., Gaviota 8 fms., Point Mugu 9 fms., Anacapa Island 15 fms., Newport 11 fms., La Jolla 1 fm. Mexico: Guaymas.

Distribution: British Columbia to Ecuador.

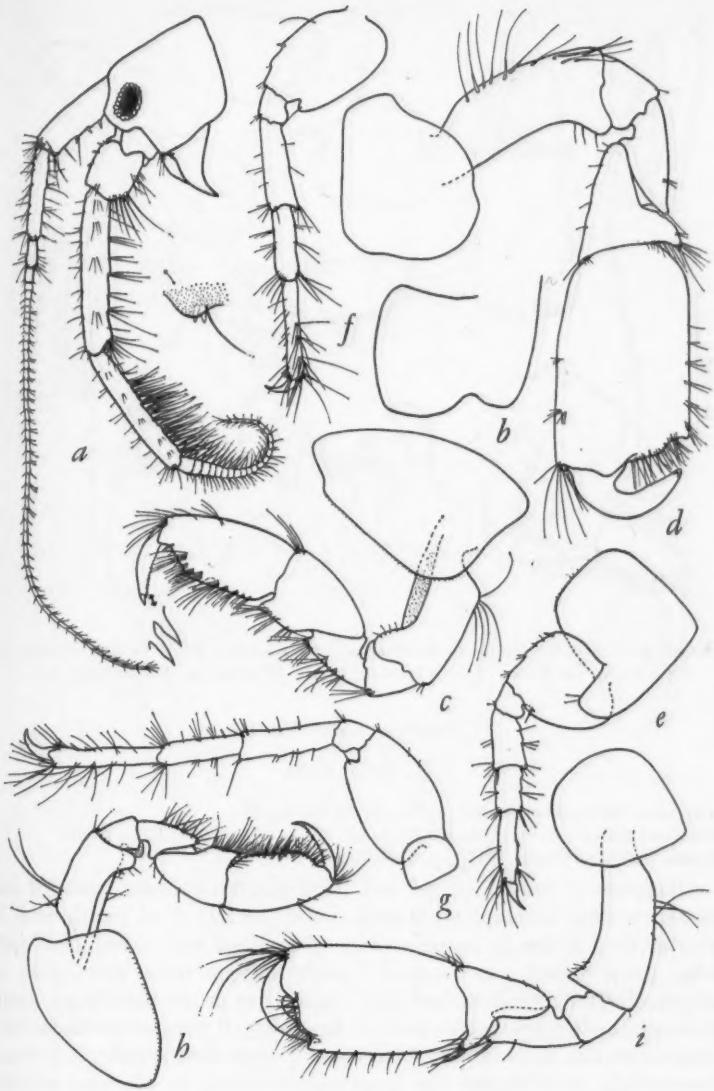

FIGURE 11.—*Ampithoe plumulosa* Shoemaker, male, 13 mm., Bahía de San Quintín: *a*, head; *b*, third pleonal epimeron; *c*, *d*, gnathopods 1, 2; *e–g*, pereopods 3, 4, 5; younger male: *h*, *i*, gnathopods 1, 2.

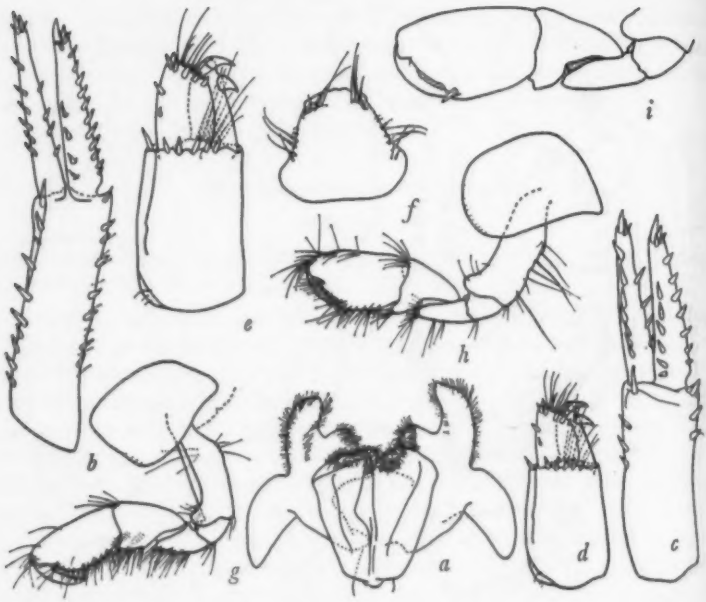

FIGURE 12.—*Ampithoe plumulosa* Shoemaker, male, 13 mm., Bahía de San Quintín: *a*, lower lip; *b–e*, uropods 1, 2, 3, 3; *f*, telson; female, 12 mm.: *g–i*, gnathopods 1, 2, 2.

Ampithoe pollex Kunkel

FIGURES 13–14

Amphithoe [sic] *pollex* Kunkel, 1910, pp. 92–94, fig. 36.
Ampithoe pollex.—J. L. Barnard, 1954, pp. 29–31, pls. 27–28; 1959, p. 37.
Grubia indentata Stout, 1913, pp. 656–657.

Diagnosis of male: Second and third pleonal epimera rounded on posteroventral corners, no lateral ridges; article 5 of gnathopod 1 shorter than article 6, posterior edge of article 5 with a rounded hind lobe, palm oblique; gnathopod 2 with oblique palm developing a progressively larger detached hind tooth that grows distalward until it overextends a transverse palmar line; a small process overrides the hinge area but is not a part of the palm; finger fitting palm in young, increasingly overlapping the large palmar tooth in old age; second articles of both gnathopods with anterodistal lobes, not strongly prominent in gnathopod 2; article 5 of gnathopod 2 with a slender, subobtuse hind lobe; article 2 of pereopods 1–2 about 3.2 times as long as broad; ventral edge of article 1 of antenna 1 not spiniferous; antenna 2 slightly longer than antenna 1, flagellum of antenna 1

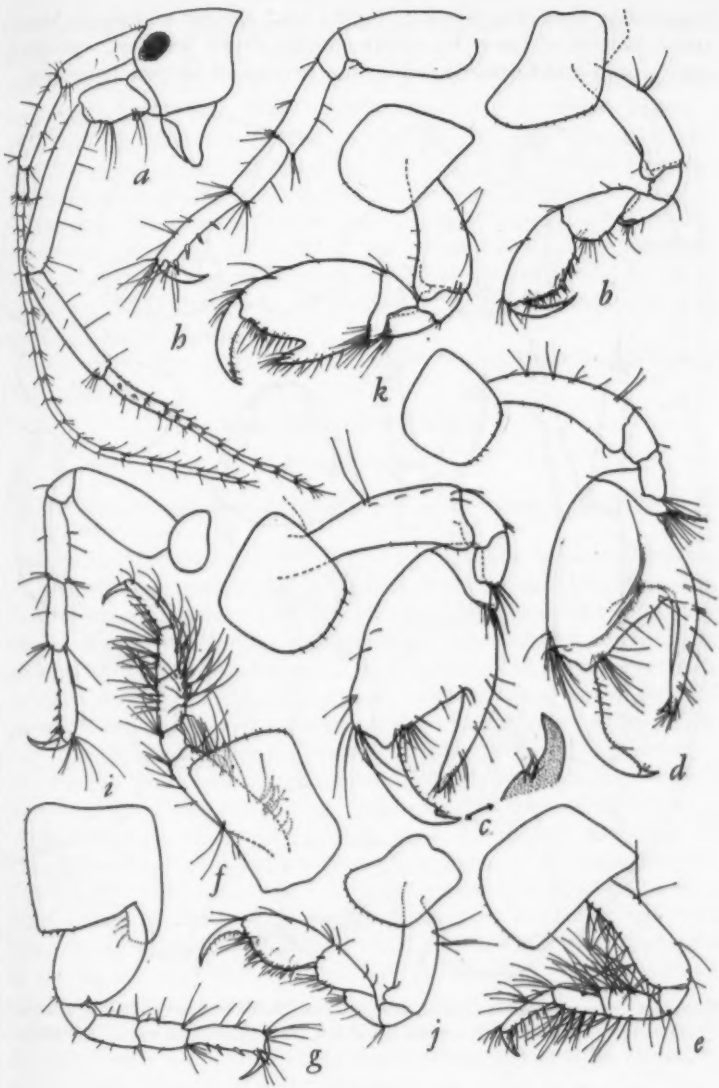

FIGURE 13.—*Ampithoe pollex* Kunkel, male, 5.0 mm., Bahía de San Quintín: *a*, head; *b*, gnathopod 1; *c*, *d*, gnathopod 2; *e–i*, pereopods 1, 2, 3, 4, 5; young male, 4.0 mm.: *j*, *k*, gnathopods 1, 2.

longer than that of antenna 2, flagella both slender and poorly setose; apical lobules of lower lip about equally short, bulbous, appressed; coxa 1 produced forward; peduncular process of uropod 1 vestigial.

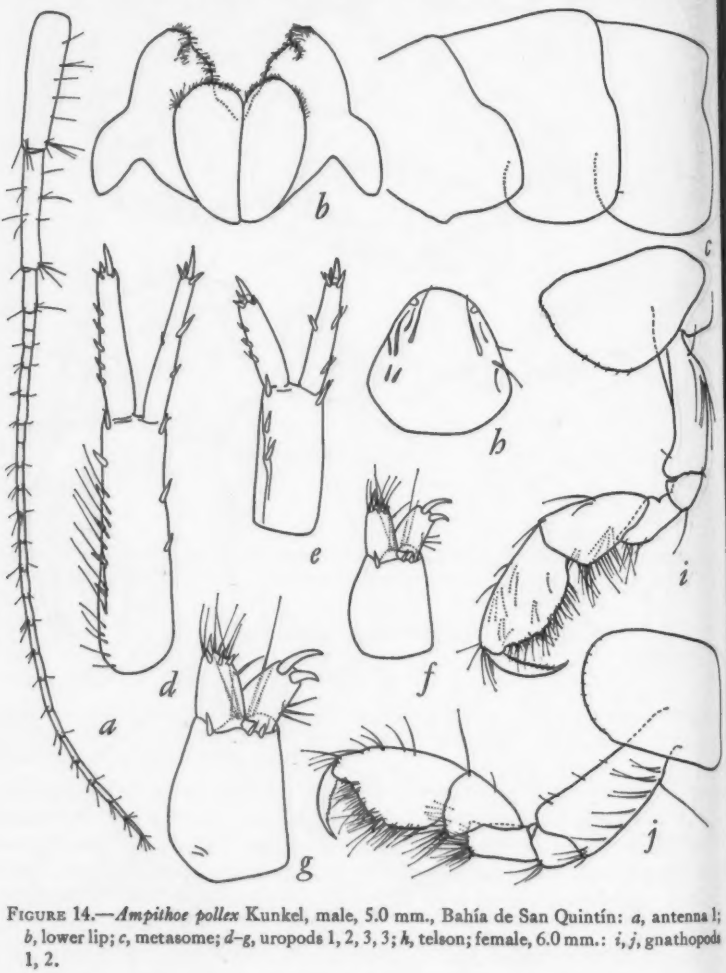

FIGURE 14.—*Ampithoe pollex* Kunkel, male, 5.0 mm., Bahía de San Quintín: *a*, antenna 1; *b*, lower lip; *c*, metasome; *d–g*, uropods 1, 2, 3, 3; *h*, telson; female, 6.0 mm.: *i*, *j*, gnathopods 1, 2.

Females: Palm of gnathopod 2 oblique, about as long as hind margin of article 6, article 5 with subacute hind lobe, broader than in male gnathopod 2.

Material: *Velero* station 1933 (1). Barnard stations 13 (26), 21 (2), 31 (21), 1 (40), 9 (23), 38 (11 samples with 154 specimens), 42 (14

samples with 151 specimens), 43 (10). Estero de Punta Banda (Ensenada), Mar. 21–23, 1951, coll. Dr. J. L. Mohr (20); Laguna Beach, Calif., Jan. 24, 1948, coll. Dr. J. L. Mohr (8); Coronado Yacht Harbor, San Diego Bay, Mar. 19, 1950, coll. Dr. J. L. Mohr (10).

Records: California intertidal at Cayucos, Hazard Canyon Reef, Point Fermin, Corona del Mar, Laguna Beach, San Diego Bay, La Jolla, Santa Catalina Island, Estero de Punta Banda, Baja California.

Remarks: *Ampithoe pollex* is very closely related to *A. folki*, Gurjanova (1938 and 1951); all of the differences that are noted in antennae and gnathopods between the drawings herein and those of Gurjanova (1951) could be attributed to mounting techniques or expressions of infraspeciation.

Distribution: Bermuda; eastern Pacific from Oregon to northern Baja California.

Ampithoe ramondi Audouin

FIGURES 15, 16

Ampithoe ramondi.—Shoemaker, 1942, p. 40.—J. L. Barnard, 1955, pp. 28–29 (with references).

Diagnosis: Second and third pleonal epimera rounded behind; article 5 of male gnathopod 1 shorter than 6, hind lobe truncate, poorly developed, article 6 rectangular and rather slender, palm very oblique and poorly developed but defined by a strong spine, finger overlapping palm; gnathopod 2 with oblique and excavate palm strongly defined by a subacute process, distal anterior end of article 6 strongly produced, heavily setose, article 6 rather long for the genus, with a moderately developed, broad and blunt hind lobe, article 2 with a large blunt lobe at anterodistal corner; article 2 of pereopods 1–2 about 2.5 times as long as broad; ventral edge of article 1 on antenna 1 setose, antenna 1 longer than antenna 2, flagellum 2.5 times as long as flagellum of antenna 2, antenna 2 moderately setose, flagellum slender, slightly longer than peduncular article 5; lateral apical lobule of lower lip projecting strongly, medial lobule very broad, blunt, scarcely projecting; coxa 1 produced forward; peduncular process of uropod 1 vestigial. Body bleached clear in alcohol, eyes dense eosin in color.

Female: Gnathopod 1 like that of male, gnathopod 2 typical of *Ampithoe*, with short article 5 having a somewhat broader lobe than normal, palm oblique, slightly concave.

Material: *Velero* stations 1378 (1), 4861 (2), 4938 (2), 5631 (2), 6206 (5).

Records: The medial apical lobule of the lower lip figured by Chevreux and Fage (1925) (as *A. vaillanti*) is more slender and more projecting than in the present material from California.

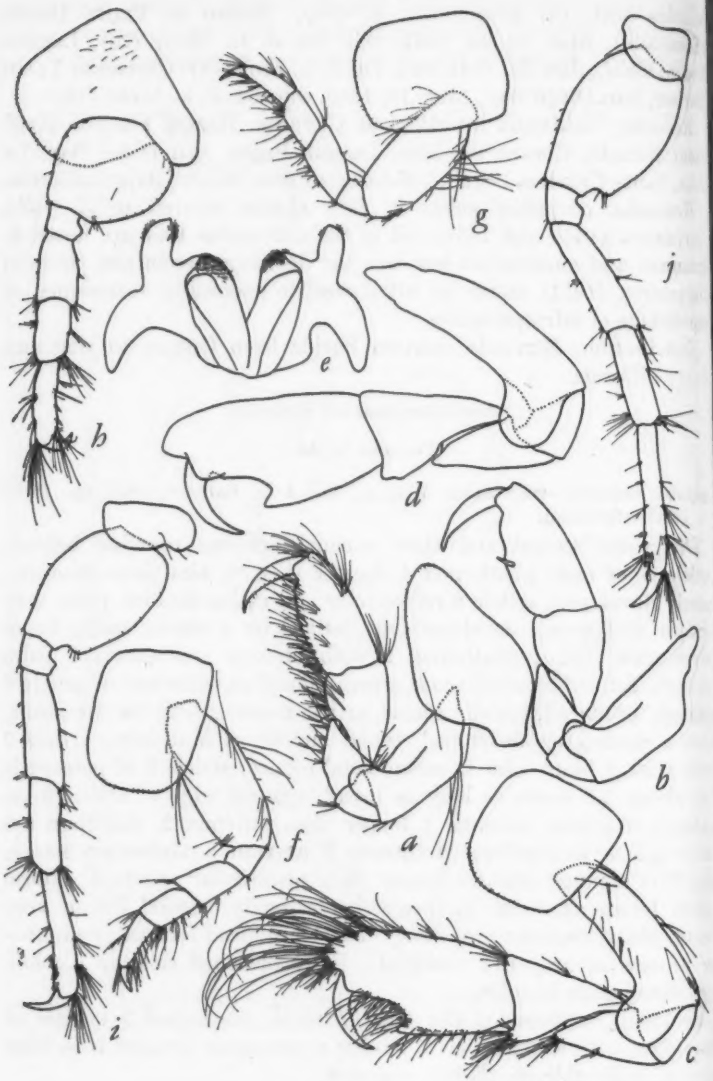

FIGURE 15.—*Ampithoe ramondi* Audouin, male, 11.5 mm., sta. 6206: *a*, *b*, gnathopod 1; *c*, *d*, gnathopod 2; *e*, lower lip; *f–j*, pereopods 1, 2, 3, 4, 5.

Relationship: This species resembles *A. simulans* in its juvenile form but differs by the distally produced article 5 of gnathopod 1.

Distribution: Circumtropical. Most northerly mainland shelf record in California is at San Mateo Point, north of Oceanside.

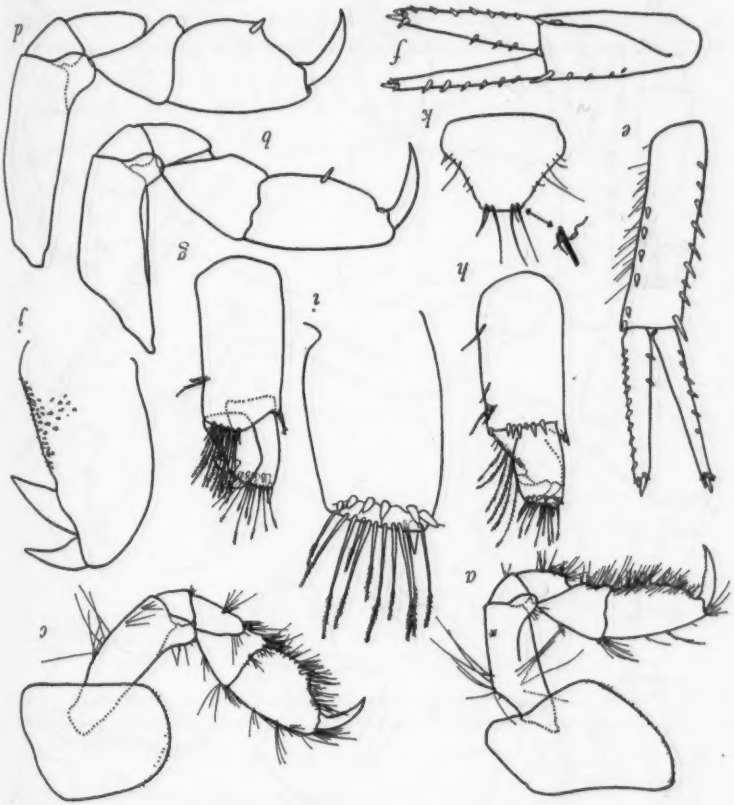

FIGURE 16.—*Ampithoe ramondi* Audouin, female, 11.0 mm., sta. 6206: *a*, *b*, gnathopod 1; *c*, *d*, gnathopod 2; male, 11.5 mm.: *e–k*, uropods 1, 2, 3, 3; *i*, *j*, inner and outer rami of uropod 3; *k*, telson.

Ampithoe simulans Alderman

FIGURES 17, 18

Ampithoe simulans Alderman, 1936, pp. 68–70, figs. 44–47.—J. L. Barnard, 1954, pp. 33–34, 1 fig.

†*Amphithoe corallina* Stout, 1912, pp. 134–136, figs. 76–77.

Diagnosis: Second and third pleonal epimera with a faint suggestion of a point at the lower posterior corners; article 5 of male gnathopod

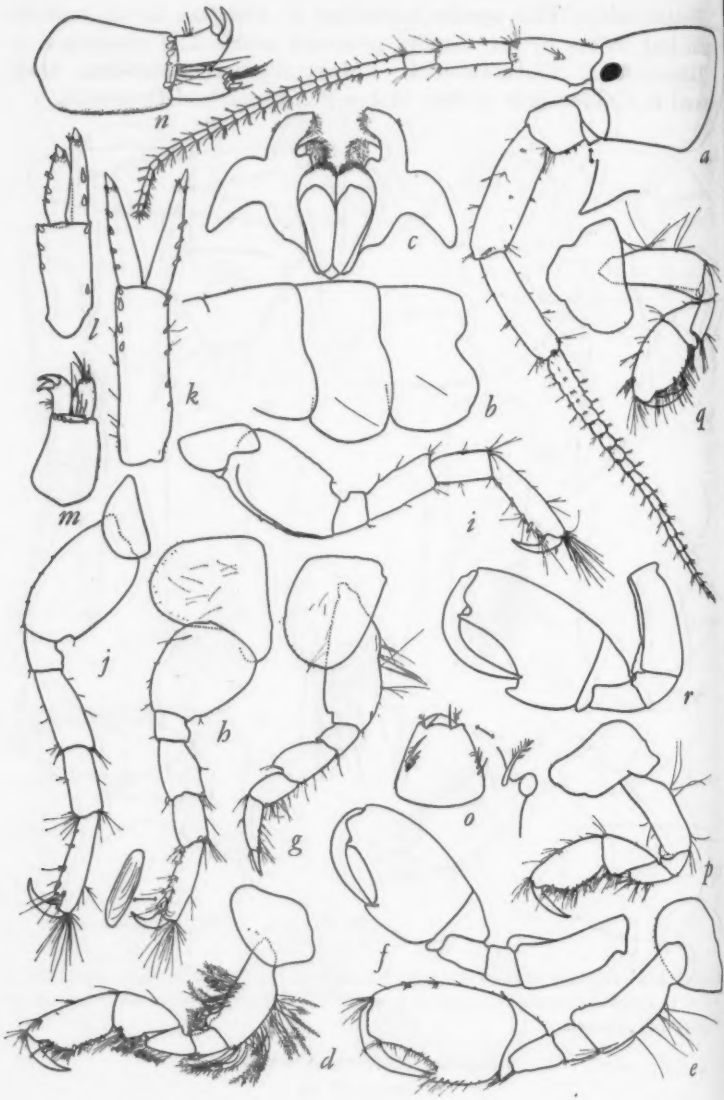

FIGURE 17.—*Ampithoe simulans* Alderman, *a*–*o*, male, 13 mm., sta. 1463: *a*, head, enlargement shows ventral surface of gland cone projecting medially; *b*, metasome; *c*, lower lip; *d*, gnathopod 1; *e*, *f*, lateral and medial views of gnathopod 2; *g*–*j*, pereopods, 1, 3, 4, 5; *k*–*n*, uropods 1, 2, 3, 3; *o*, telson; female, 9 mm., 8-29-50, coll. J. L. Mohr: *p*, *q*, gnathopods 1, 2; male, 11 mm., same sample: *r*, gnathopod 2.

1 shorter than article 6, posterior edge of article 5 with a shallow, broad hind lobe, palm oblique; articles 2–5 strongly setose; male gnathopod 2 with palm quite oblique, excavated to form a short thumb at defining corner which increases in extension with the elongation and further disproportion of the palm, a small process near the finger hinge increasing in development also; dactylus fitting palm in young males, failing to fit palm in old males; article 2 of pereopods 1–2

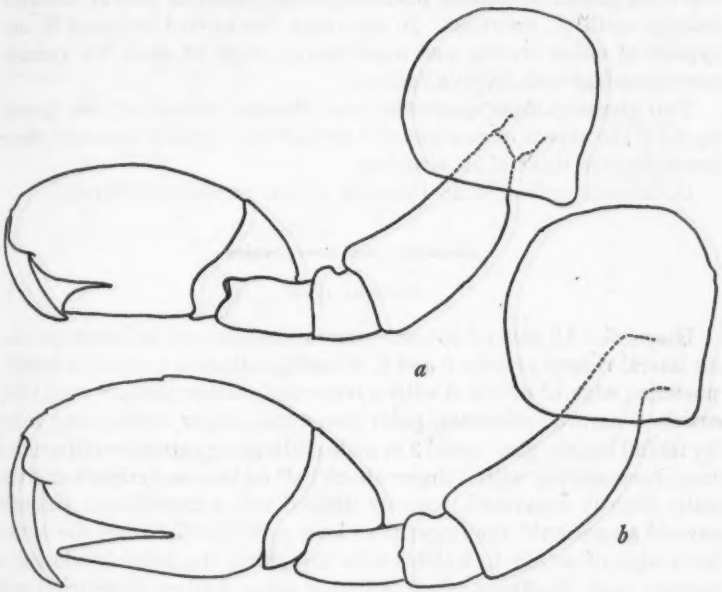

FIGURE 18.—*Ampithoe simulans* Alderman, aberrant specimens similar to *A. pollex* in second gnathopodal morphology: *a*, male, 8.0 mm., Barnard sta. 40–A; *b*, male, 9.0 mm., Barnard sta. 40–A.

about 2.5 times as long as broad; ventral edge of antenna 1, article 1 not spiniferous; antenna 2 longer than antenna 1, flagellum of antenna 1 longer than that of antenna 2, flagella both poorly setose; outer apical lobule of lower lip slightly longer than inner lobule, the two small apical spines on sixth articles of the pereopods are fluted (see figures); coxae 1 and 2 scarcely half as long as coxae 3–5; peduncular process of uropod 1 vestigial.

Female: Article 5 of gnathopod 1 shorter than article 6, the appendage not as setose as on male; article 5 of gnathopod 2 like that of male gnathopod 2, much shorter than on gnathopod 1, with a narrow hind lobe.

Material: Reported by Barnard, 1954. *Velero* stations 1463 (1), 1489 (1). Barnard station 40 (2).

Records: Coos Bay, intertidal; North Bay, Cape Arago State Park, Oreg., intertidal. Coal Oil Point, near Goleta, Calif.

Remarks: Possibly *Ampithoe corallina* represents a senior synonym of this species. The shape of the lower lip and gnathopod 1 correspond well with the female of *A. simulans* but Stout draws a small point on the third pleonal epimeron, possibly giving indication that *A. corallina* belongs with *A. lacertosa*. In any case the second antenna is not typical of either species and more search must be made for animals corresponding with Stout's figures.

Two aberrant male specimens from Barnard station 40 are figured to show the aspect of gnathopod 2 similar to *A. pollex;* however, their lower lips are those of *A. simulans*.

Distribution: Oregon to Coal Oil Point, southern California.

Ampithoe tea, new species

FIGURES 19–21

Diagnosis: All pleonal epimera rounded behind and at lower corners, no lateral ridges; articles 5 and 6 of male gnathopod 1 equal in length, posterior edge of article 5 with a truncated, rather shallow hind lobe, article 6 narrow, sublinear, palm transverse, finger overlapping palm by its full length; gnathopod 2 in male undergoing extensive differentiation, commencing with a finger about half as long as article 6 and the palm slightly excavated, scarcely defined and quite oblique, through several stages until the finger is as long as article 6, fitting the entire hind edge of article 6, which forms the palm, the palm developing a process near the finger hinge, followed by a shallow excavation and then a relatively straight but sloping edge, the palmar edge minutely crenulated; the finger becoming increasingly bent at its base; article 2 of gnathopod 2 with poorly developed distal bump; article 2 of pereopods 1 and 2 strongly inflated, 1.9 times as long as broad; article 2 of pereopod 3 broader than long; ventral edge of article 1 of first antenna not spiniferous; antenna 1 much longer than antenna 2, the flagellum of antenna 1 more than four times as long as that of antenna 2, the latter flagellum rather short, 0.5 times as long as article 5 of peduncle, and the second antenna rather setose; article 4 of peduncle 120% as long as article 5; outer apical lobule of lower lip somewhat longer than medial lobule; coxae 1 and 2 shorter than 3 and 4 but not broadened, coxa 1 not produced forward; peduncular process of uropod 1 long.

Female: Article 5 of gnathopod 1 shorter than article 6 and thus shorter than in the male; gnathopod 2 with article 6 similar to that of

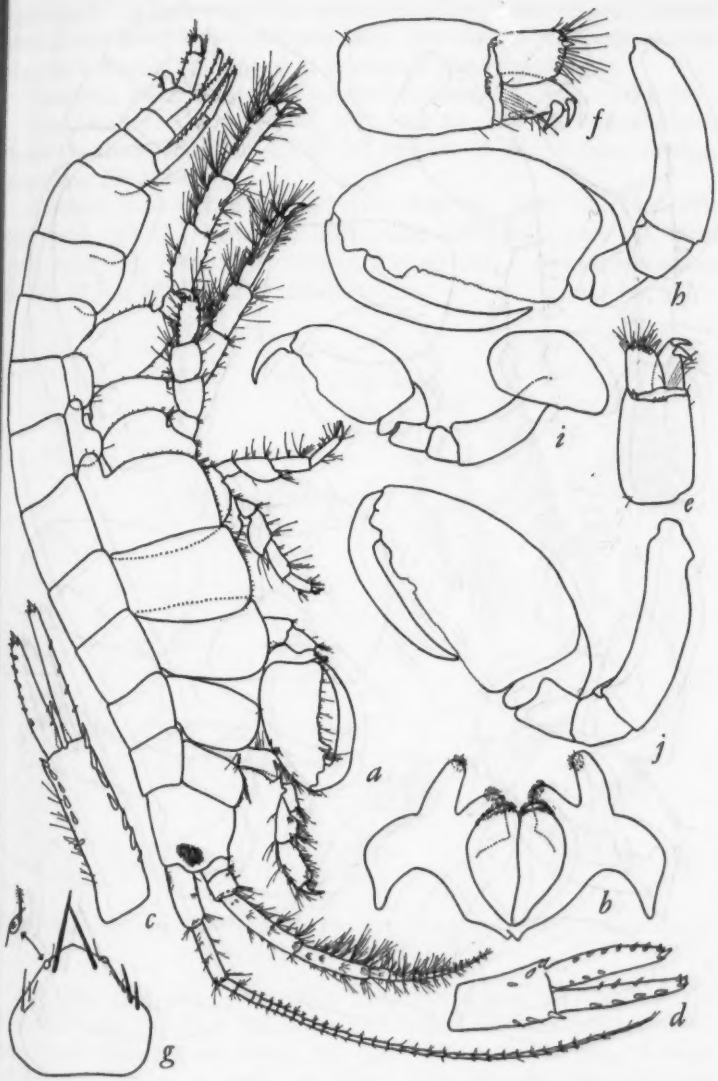

FIGURE 19.—*Ampithoe tea*, new species, male, holotype 12.0 mm., sta. 1870: *a*, lateral view; *b*, lower lip; *c–f*, uropods 1, 2, 3, 3; *g*, telson; male, 10 mm.: *h*, gnathopod 2; male, 6.0 mm.: *i*, gnathopod 1; male, 8.0 mm.: *j*, gnathopod 2.

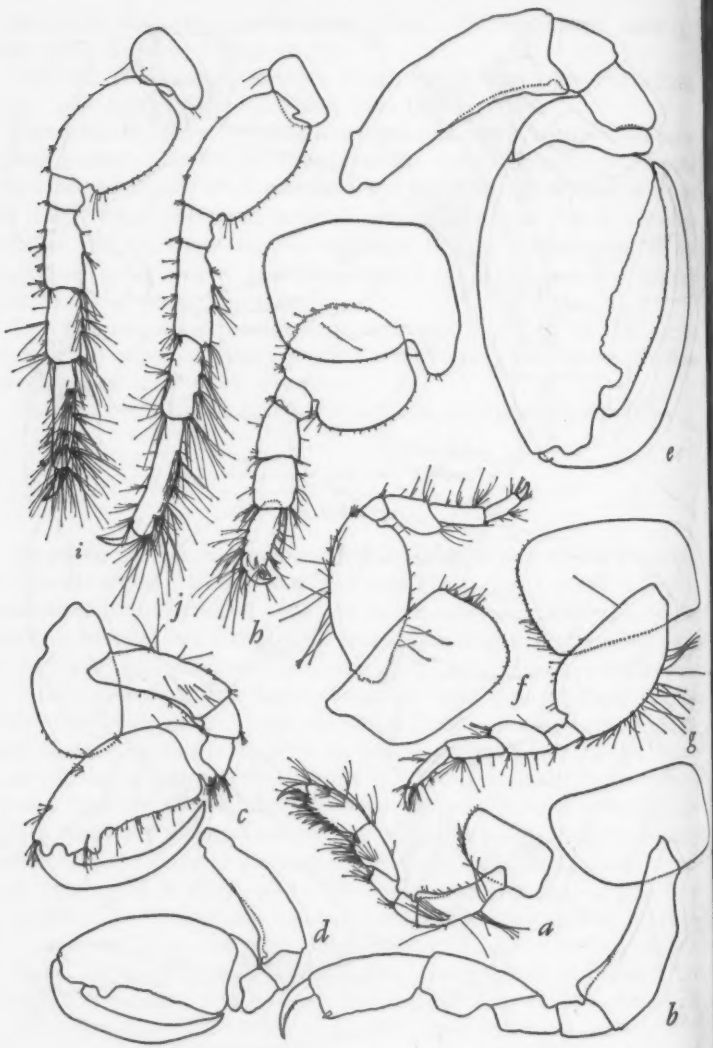

FIGURE 20.—*Ampithoe tea*, new species, male, holotype, 12 mm., sta. 1870: *a*, *b*, gnathopod 1; *c-e*, gnathopod 2; *f-j*, pereopods 1, 2, 3, 4, 5.

gnathopod 1 in both sexes but stouter and less linear, article 5 shorter than 6 and with well-developed hind lobe that is relatively stouter than that of male gnathopod 2; antenna 2 poorly setose.

Holotype: Allan Hancock Foundation No. 4921, male, 12.0 mm.

Type locality: *Velero* station 1870, 0.2 mi. NE. of Willow Cove, Santa Catalina Island, 33–22–17 N., 118–20–55 W., 21 fms., dredge, kelp, Aug. 25, 1949.

Material: *Velero* stations 1221 (2), 1370 (2), 1375 (1), 1381 (7), 1407 (1), 1453 (3), 1623 (1), 1870 (122), 1871 (44), 1924 (3), 2080 (13), 5369 (7), 6695 (37), 6696 (2), 6803 (15). Barnard stations 33 (7), 37 (1), 39–J–1 (?16), 39–K–1 (11).

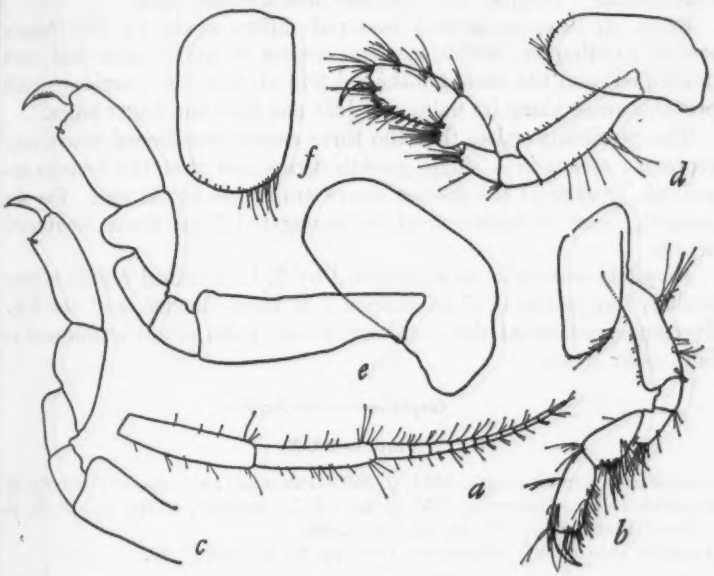

FIGURE 21.—*Ampithoe tea*, new species, female, 8.5 mm., sta. 1870: *a*, antenna 1; *b*, *c* gnathopod 1; *d*, *e*, gnathopod 2; *f*, coxa 3.

Records: California, intertidal: Santa Catalina Island; Coal Oil Point; Corona Del Mar. Santa Catalina Island, several localities, 18–37 fms.; near Point Conception, 2–3 fms.; off Santa Barbara, 9 fms.; off Laguna Beach, 10 fms.; La Jolla, 1 fm.: 20 miles east of Punta Eugenia, Baja California, intertidal; Guadalupe Island, Baja California, 25 fms.

Relationship: This material differs from *Ampithoe eoa* Gurjanova (1938 and 1951) by the equally broad fifth and sixth articles of pereopod 5, by the development of a palmar process near the finger

hinge of gnathopod 2, and by the much more slender second gnathopod of the female having a transverse, not oblique and slightly sinuous palm.

From *A. mea* Gurjanova (1938 and 1950) this species differs by the development of a palmar process on male gnathopod 2, the broader second article of pereopod 3 and the more slender female gnathopod 2 with transverse palm. The present material corresponds with *A. mea* in the strongly setose second male antenna; the male gnathopod 2 figured by Gurjanova could be one stage of the development in the present material. The female gnathopod 2 shown by Gurjanova, however, is most distinct; otherwise I should assign this material to that species. Possibly her "female" was a young male.

From *A. annenkovae* this material differs again by the female second gnathopod, which in that species is quite large and well developed, and the male gnathopod 2 of *A. mea* has a series of small protuberances along its palm, not just one near the finger hinge.

The possibility exists that the three species mentioned above may represent stages in a single growth series and that the females described for each of the species above are stages of old age. For the present, these materials must be segregated from those mentioned above.

Ampithoe orientalis, as redescribed by J. L. Barnard (1955) is very similar, but article 6 of gnathopod 1 is more slender, and the fully developed process at the distal end of the palm is not sculptured as fully as in *A. tea*.

Ampithoe valida Smith

FIGURES 22, 23

Amphithoë [sic] *valida* Smith, 1873, p. 563.—Paulmier, 1905, pp. 164–165, fig. 34.
Ampithoe valida, Alderman, 1936, p. 68.—J. L. Barnard, 1954a, pp. 34–35, pl. 31.—Nagata, 1960, 176, pl. 16, figs. 97–98.
Ampithoë shimizuensis Stephensen, 1944, pp. 77–80, figs. 27–28.

Diagnosis: Second and third pleonal epimera with very slight points at lower posterior corners; article 5 of male gnathopod 1 slightly longer than article 6, posterior edge of article 5 forming a broad hind lobe with a distal projection, article 2 strongly setose, palm oblique; gnathopod 2 with large rounded lobes on articles 2 and 3, article 5 with narrow hind lobe, article 6 elongated, rectangular, palm transverse, bearing a quadrate middle bump, finger curved, fitting palm; article 2 of pereopods 1–2 about 2.5 times as long as broad; ventral edge of article 1 on antenna 1 bearing setae, no spines; antennae 1 and 2 equal in length, flagellum of antenna 1 twice as long as that of antenna 2, neither flagellum strongly setose; apical lobules of lower lip so broad and appressed that they mask their separating

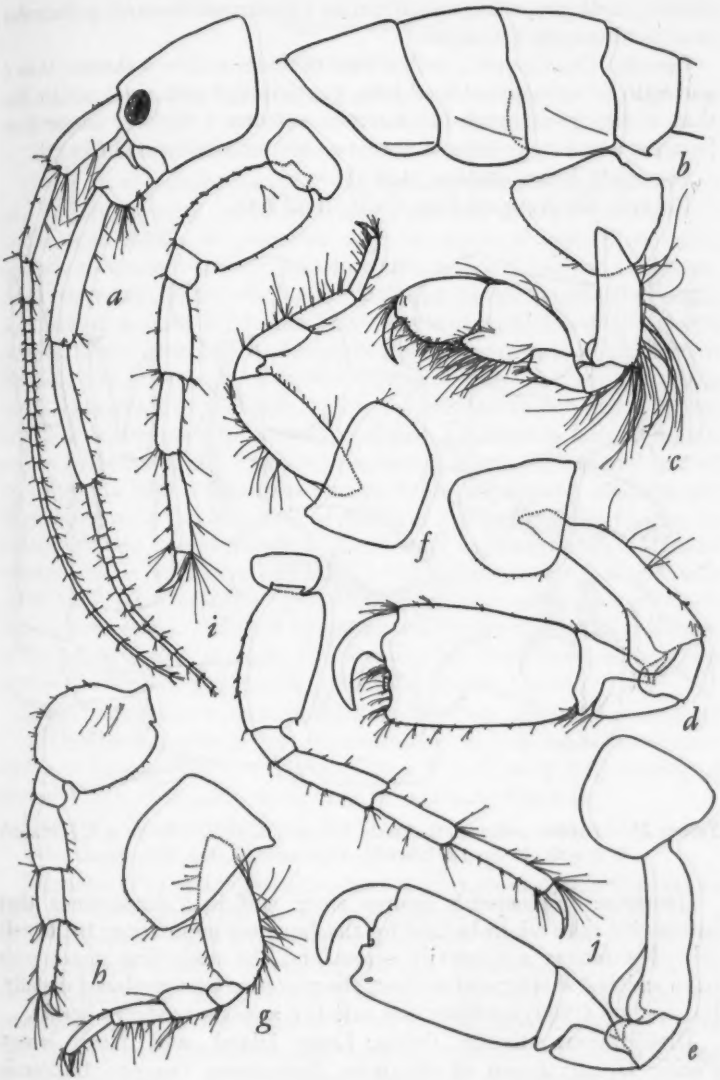

FIGURE 22.—*Ampithoe valida* Smith, male, 10.0 mm., Coos Bay, Oreg.: *a*, head; *b*, metasome; *c*, gnathopod 1; *d*, *e*, gnathopod 2; *f*-*j*, pereopods 1, 2, 3, 4, 5.

incision, both projecting equally; coxa 1 produced forward; peduncular process of uropod 1 vestigial.

Female: Gnathopod 1 unlike that of male, article 5 shorter than 6 and with an unmodified hind lobe, gnathopod 2 with sixth article like that of first gnathopod, but stouter; antenna 1 slightly longer than in male, hence both pairs of antennae are more unequal in length.

Material: *Velero* station 1453 (1).

Record: Off Newport Bay, Calif., 6–18 fms.

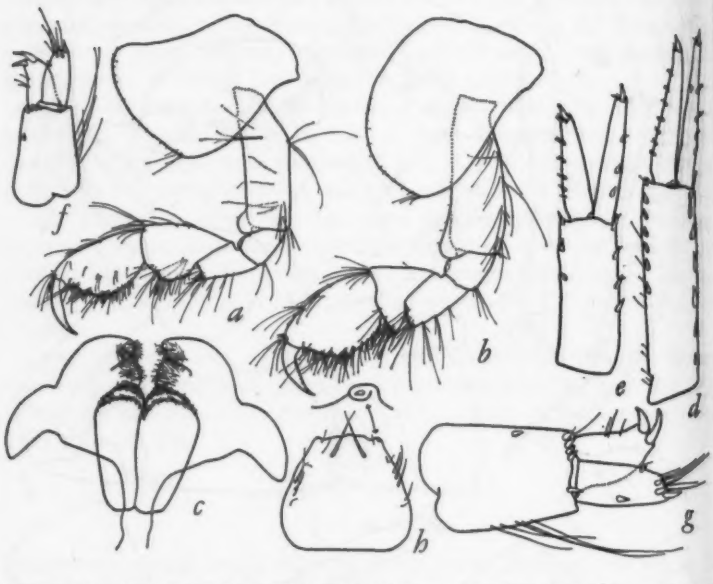

FIGURE 23.—*Ampithoe valida* Smith, female, 12.0 mm., Coos Bay, Oreg.: *a*, *b*, gnathopods 1, 2; male, 10 mm.: *c*, lower lip; *d*–*g*, uropods 1, 2, 3, 3; *h*, telson.

Remarks: Stephensen's figures show sufficient distinctions that subspecific rank might be held for the Japanese population; the female second antennae are heavily setose and the male first gnathopods have article 5 shorter and without the posterior lobe produced distally, but Nagata (1960) confirms that article 5 appears as shown herein.

Distribution: Atlantic Ocean: Long Island and New Jersey. Pacific Ocean: Japan at Shizuoka Prefecture; Oregon; California south to Newport Bay.

Ampithoe species

FIGURES 24, 25

Refer to: *Amphitoe* [sic] *mea* Gurjanova, 1938, pp. 361–364, fig. 53; 1951, pp. 882–885, fig. 616. *Ampithoe eoa*.—J. L. Barnard, 1954, pp. 27–28, pls. 25–26 (not Gurjanova 1938).

Diagnosis of present material: All pleonal epimera rounded behind and at lower corners, no lateral ridges; article 6 of male gnathopod 1 longer than article 5, posterior edge of article 5 with a rounded, scarcely truncated, shallow posterior lobe, article 6 narrow, sublinear, palm transverse, finger overlapping palm by its full length; gnathopod 2 of male in a state of intermediacy compared with *Ampithoe tea*, new species, finger about half as long as hind edge of article 6, palm not distinct, the hind edge of article 6 minutely serrate, with a slight notch near distal end, article 2 with a poorly developed distal bump; article 2 of pereopods 1–2 strongly inflated, 1.6 times as long as broad; article 2 of pereopod 3 broader than long; ventral edge of article 1 of first antenna with a few distal slender spines; antenna 1 much longer than antenna 2, the flagellum of antenna 1 about 3 times as long as that of antenna 2, the latter flagellum short, 1.3 times as long as article 5 of peduncle, articles stout, antenna 2 well setose, article 4 of peduncle about 90% (aberrantly 60% as in figured male) as long as article 5; outer apical lobule of lower lip somewhat longer than medial lobule; coxae 1 and 2 shorter than 3 and 4 but not broadened, coxa 1 not produced forward; peduncular process of uropod 1 long.

Female: Article 5 of gnathopod 1 shorter than article 6; gnathopod 2 with article 6 similar to that of gnathopod 1 in both sexes but stouter and less linear, article 5 shorter than 6 and with well-developed posterior lobe that is narrower than in *A. tea*, new species.

Material: Barnard station 5 (5).

Record: Corona del Mar, Calif., intertidal.

Remarks: The specimens differ from the figures of *A. mea* Gurjanova (and *A. eoa* Gurjanova) in the female second gnathopod, having a transverse palm with a strongly overlapping finger. In *A. mea* the female second gnathopod has an oblique, excavated palm with the finger fitting it and a longer fourth article of antenna 2. I suggest the possibility that *A. mea* females shown by Gurjanova may be either aberrant, gerontic females commencing to demonstrate male conditions or subadult males. The correspondence of *A. annenkovae* Gurjanova (see 1951) to *A. mea* is striking. The male and female second gnatho-

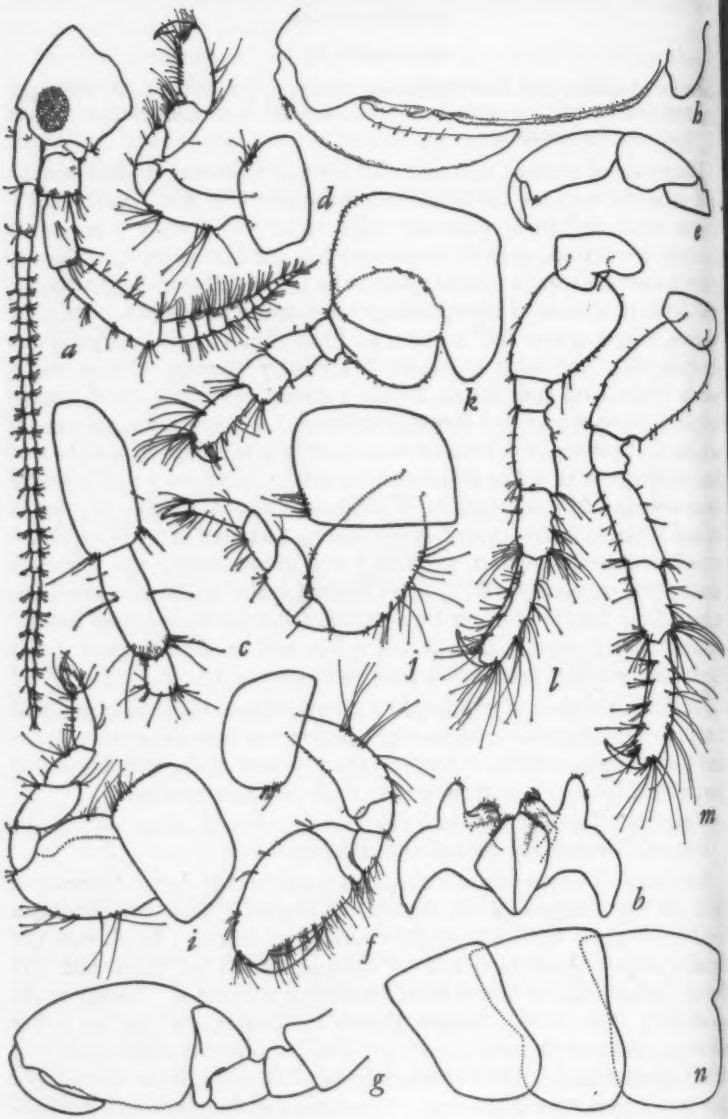

FIGURE 24.—*Ampithoe* species, male, 8.0 mm., Barnard sta. 5: *a*, head; *b*, lower lip; *c*, peduncle of antenna 1; *d*, *e*, gnathopod 1; *f-h*, gnathopod 2; *i-m*, pereopods 1, 2, 3, 4, 5; *n*, metasome.

pods are simply later growth stages if one considers that *A. mea* undergoes the same terminal development seen in other Ampithoes. If those two species prove to be the same, then the female second gnathopod may be normal in *A. mea* and the present material would have to be established nomenclaturally.

A. eoa has a broadened fifth article of pereopod 5 and longer and more truncate article 5 of male gnathopod 1.

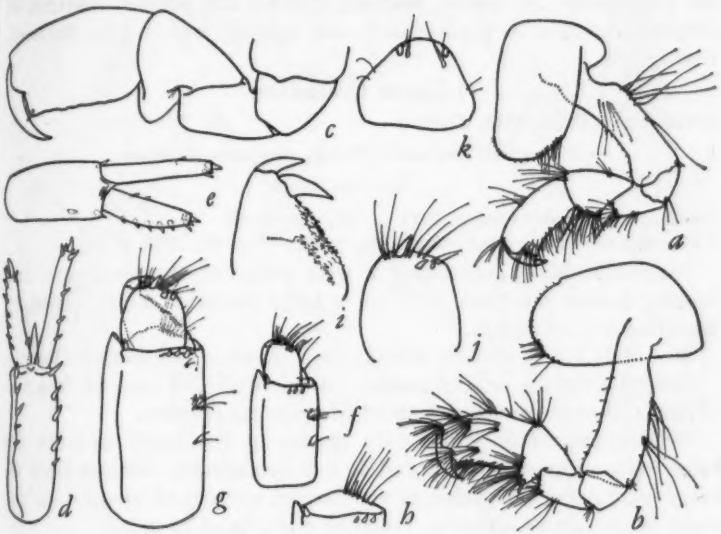

FIGURE 25.—*Ampithoe* species, female, 9.6 mm., Barnard sta. 5: *a*, gnathopod 1; *b*, *c*, gnathopod 2; male, 8.0 mm.: *d*–*g*, uropods 1, 2, 3, 3; *h*, end of peduncle of uropod 3; *i*, *j*, outer and inner rami of uropod 3; *k*, telson.

Ampithoe orientalis, as redescribed by J. L. Barnard (1955), has a somewhat more slender sixth article of gnathopod 1 and an elongated, slender, second antenna.

The second gnathopod of the female *A. annenkovae* (see Gurjanova, 1951) is enlarged somewhat as in the male and has an oblique palm.

The material identified by Barnard (1954) as *A. eoa* differs from that species in the structure of pereopod 5 and by the equal lobation of the lower lip. Except for the male gnathopods, that material might be confused with *A. lindbergi*. Both *A. mea* and the present material have the unequal lobation of the lower lip; hence *A. eoa* of Barnard (1954) is unassignable to a known species, but is not worthy of designation until more Oregonian materials can be studied. Because only 5 specimens of the present material are known from the coast of southern California and they have the aspect of the northern

Ampithoes, it is presumed they represent a marginal population that will find assignment to a northern species. The aberrancy of the shortened fourth article of antenna 2 of one of the males indicates the marginality of the deme.

In summary, these several populations of closely related ampithoes are now recorded, but relationships and taxonomic assignments are still unclear: *Ampithoe mea* Gurjanova, *A. eoa* Gurjanova, *A. annenkovae* Gurjanova, *A. eoa* of Barnard (1954), the present material of *Ampithoe* species, *A. tea* Barnard, new species, and *A. plea* Barnard, new species.

Genus *Cymadusa*

Acanthogrubia Stout, 1912, p. 143.

Cymadusa uncinata (Stout), new combination

FIGURES 26–28

Acanthogrubia uncinata Stout, 1912, p. 146, figs. 81–83.
Paragrubia uncinata.—Shoemaker, 1941, p. 188.—Hewatt, 1946, p. 199.

Diagnosis: Male gnathopod 2 with palm nearly transverse and bearing a deep slit that splits off a large posterior tooth; accessory flagellum 3–5 articulate.

Material: *Velero* station, 878–38 (3). Barnard station 41 (100+).

Records: Goleta and Anacapa Island, Calif., 2 and 15 fms.; at Goleta collected from holdfasts of *Macrocystis pyrifera.*

Relationship: This is the only species of the genus to have the large tooth of gnathopod 2, and so it is remarkably distinct from its relatives. Apparently this is the largest amphipod species on the coast of southern California, reaching a length of 35 mm.

Shoemaker transferred this species to *Paragrubia*, but it belongs with *Cymadusa* because gnathopod 1 is smaller than gnathopod 2, the reverse of the condition of *Paragrubia.*

Distribution: Southern California.

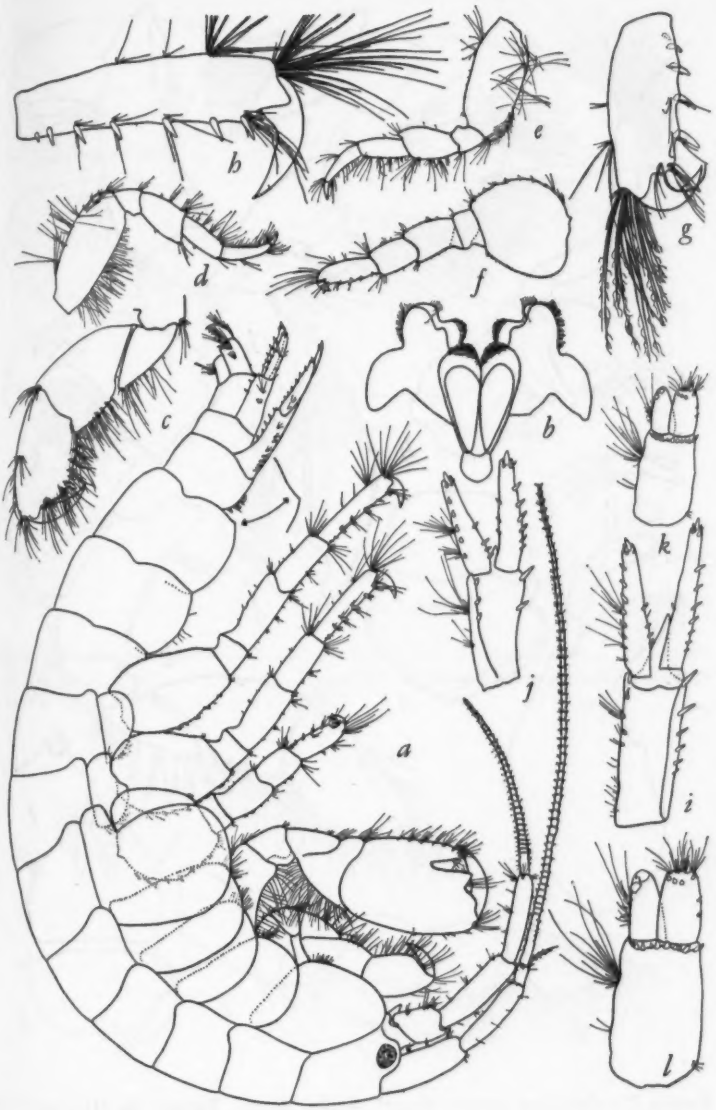

FIGURE 26.—*Cymadusa uncinata* (Stout), male, 20 mm., Barnard sta. 41: *a*, lateral view; *b*, lower lip; *c*, gnathopod 1; *d*, *e*, pereopods 1, 2; *f*, *g*, pereopod 3; *h*, pereopod 5; *i–l*, uropods 1, 2, 3, 3.

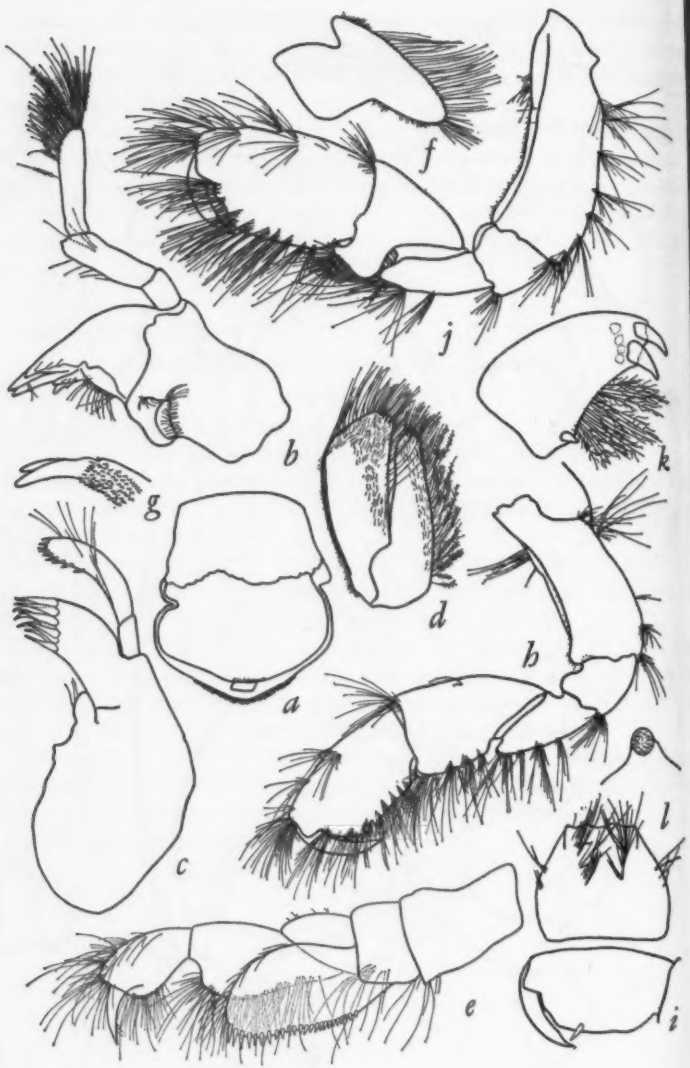

FIGURE 27.—*Cymadusa uncinata* (Stout), female, 30 mm., Barnard sta. 41: *a*, upper lip; *b*, mandible; *c*, *d*, maxillae 1, 2; *e*, maxilliped; *f*, inner plate of maxilliped; *g*, end of maxillipedal palp; *h*, *i*, gnathopod 1; *j*, gnathopod 2; *k*, outer ramus of uropod 3; *l*, telson.

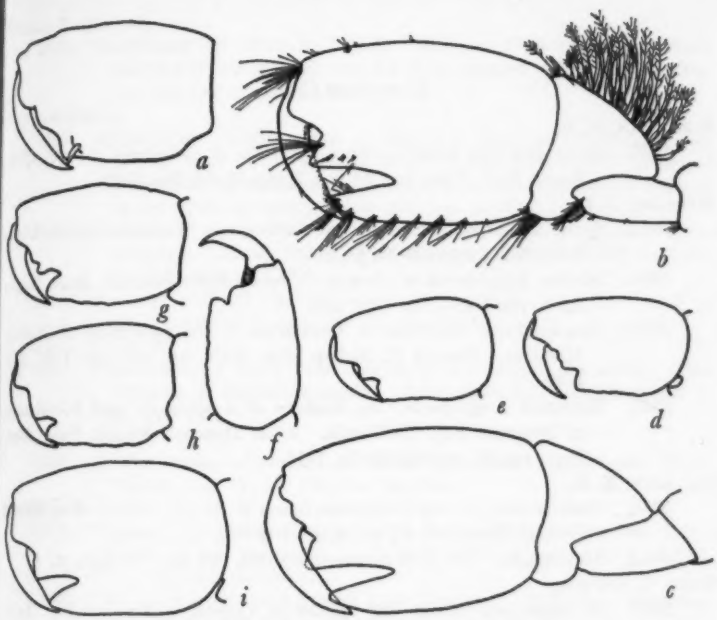

FIGURE 28.—*Cymadusa uncinata* (Stout), female, 30 mm., Barnard sta. 41: *a*, medial view of gnathopod 2; male, 20 mm.: *b*, *c*, lateral and medial views of gnathopod 2; developmental stages in male gnathopod 2: *d–i*.

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SPECIES OF OEDEMERIDAE OF THE BIG BEND REGION OF TEXAS

By ROSS H. ARNETT, JR.

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SPECIES OF OEDEMERIDAE OF THE BIG BEND REGION OF TEXAS[1]

By Ross H. Arnett, Jr.[2]

During May 1959, Drs. Henry F. Howden and Edward Becker made very extensive and interesting collections of insects in and near Big Bend National Park, Tex. This particular collecting trip has resulted in the detection of many rare and several undescribed species in this poorly sampled area. The truth of this statement becomes more apparent as their material is made available to the specialists. Although there were "several good general rains totaling two to three inches . . . during the month of May" (Howden, 1960), this alone does not account for the wealth of material collected by these two entomologists. After having been in the field with Dr. Howden, I am convinced there is more than luck involved in the collection of these rare species. His thorough and persistent methods, during which time personal comfort is not his concern, has contributed greatly to the progress of beetle taxonomy and biology. It is for this reason that I wish to dedicate the new species described in this paper to Dr. Howden. I also wish to acknowledge with thanks the loan of this material by the Canadian National Collection of Insects.

[1] Contribution toward a monograph of the Oedemeridae, no. 21.

[2] Department of Biology, Catholic University of America, Washington, D.C.

Family characteristics: These polyphagous beetles range in size from 5 to 20 mm. in length, but most specimens are between 8 and 12 mm. Their body surface has a soft appearance, and the moderate vestiture of recumbent setae covers the somewhat shining body surface. The color is fuscus to testaceous, or bicolorous with head and/or pronotum reddish orange, more rarely, dark or piceus or metallic colored. The head is not strongly constricted behind the eyes. The antennae are filiform. The pronotum is broadest anteriorly or at middle, without lateral margins. The procoxal cavities are open behind and the tarsal formula is 5–5–4, with at least the penultimate segment dilated and tomentose ventrally; claws simple, or with a basal tooth.

Key to the Species of Big Bend Oedemeridae[3]

1. Antennal base situated within deep emargination of eyes; mandibles entire (Calopodinae) . . . . . **Sparedrus depressus** (Champion)
   Antennal base situated in front of eyes which are emarginate (Oedemerinae) 2
2. Both mandibles entire 5
   Both mandibles bifid at apices 3
3. Second antennal segment short, one-third or less length of third segment; head and elytra piceus, pronotum reddish orange.
   Eumecomera obscura (LeConte)
   Second antennal segment long, one-half or more length of third segment . . 4
4. Second antennal segment nearly as long as third; body slender; eyes nearly entire; pronotum with nearly parallel sides; uniformly dark, metallic in color.
   Vasaces elongatus Arnett
   Second antennal segment approximately one-half length of third; eyes reniform; pronotum much broader anteriorly than at base; color fuscus.
   Oxycopis howdeni Arnett
5. Vestiture very coarse and dense, obscuring punctation.
   Oxacis pallida LeConte
   Vestiture coarse to fine, but not obscuring punctation 6
6. Head, thorax, and elytra fuscus or reddish brown 7
   Thorax orange red with or without darker markings 9
7. Each elytron marked with two orange striae (to distinguish from *O. bernadettes*, not yet reported from Big Bend Region, pronotum without anterior lateral mirror spots) . . . . . **Oxacis barbara** Arnett
   Elytra without orange striae 8
8. Head and pronotum piceus brown with testaceus markings; elytra with sutural area pale; elongate narrow species; pubescence fine.
   Oxacis angustata Champion
   Color uniformly reddish brown; elytra rarely stained with piceus.
   Oxacis subfusca Horn

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[3] For full descriptions and illustrations of these species and others that might occur in the area, see bibliography. This key includes only the known species in the Big Bend Region and is so designed that, should additional species be found in the region, they will not be mistaken for the included species.

9. General color reddish orange, elytra stained at base with piceus to entirely piceus; mandibles usually large; pronotum distinctly marked with central piceus stripe, and a piceus patch on each side.
Oxacis trimaculata Champion

Elytra purple piceus, often with very narrow pale sutural and marginal stripe, rarely with vague submarginal pale stripe; pronotum orange, usually with piceus markings . . . . . **Oxacis cana** (LeConte)

The following list of Big Bend National Park species is complete as of this writing. Although other collections have been made in the Park previously and since, including collections made by the author, only one additional species has been taken which was not collected by Howden and Becker. Only this additional record is included. No doubt additional collecting at other times during the season will reveal still more species.

No extensive ecological characterization of the area has been made. Webb (1950) and others (e.g., Peterson, 1960) refer to the area as the Trans-Pecos community which corresponds to Dice's (1943) Chihuahuan Biotic province. Plant succession in the area has been described to some extent by Muller (1940). Some of the more striking plants are described in McDougall and Sperry (1951). The geology of the region is reported by Udden (1907). Howden (1960) has published a map of the area, which is reproduced here, and a list of the Scarabaeidae. All of the Big Bend National Park localities mentioned in the following discussion are located on this map (fig. 1).

***Sparedrus depressus* (Champion)**

This species was taken at Chisos Basin May 1–8 by beating gray oak and at light. At Tornillo Flat specimens were taken on May 12 by beating *Acacia* species. This is the first record of the species in the United States.

The species was described from a single male specimen taken at Mexico City. It has not been again reported until this collection of 13 specimens. As in other species of this genus, the fifth visible sternum of the male is deeply emarginate in contrast to the slightly emarginate condition in the female.

***Vasaces elongatus* Arnett**

The type locality of *V. elongatus* is Chisos Basin (pl. 1, top). Until this collection of six specimens, the species was known only from the female holotype. The specimens reported here were collected at light between May 23 and 29. The description of the male follows:

Male: Chisos Basin, Big Bend National Park, Tex., May 29, 1959 (collected by Howden and Becker). The male agrees with the female holotype except as follows: front of head coarsely punctate, depressed somewhat behind antennae. Pronotum longer than broad

(4:3), but shorter than that of the female; widest anterior to middle, lateral arcuation more pronounced than in the female. Length 9 mm.

Male genitalia: Fifth visible abdominal sternum emarginate apically. The genitalia agree with the generic description (Arnett,

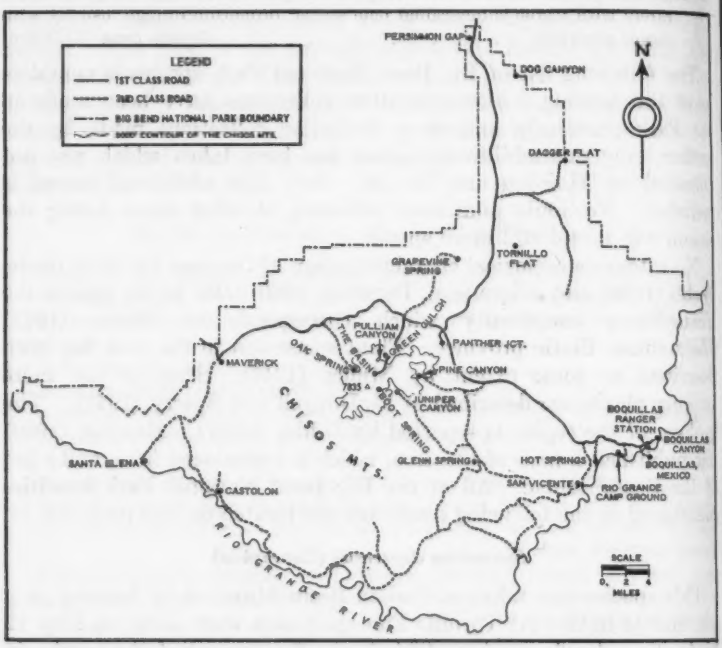


FIGURE 1.—Big Bend National Park, Brewster Co., Tex., collecting localities (the 5000 ft. contour of the Chisos Mts. is included for reference; by permission of *The Canadian Entomologist*).

1953, p. 89) except that the penis (fig. 2*a*) is slightly expanded at the apex; paramere (fig. 2*b*) with apical V-shaped emargination narrower and deeper than in *V. linearis*. Ninth tergum not as prominent as in *V. linearis*.

***Eumecomera obscura* (LeConte)**

This species was not collected by Drs. Howden and Becker, but was taken later in the season (July 17, 1946) by D. J. and J. N. Knull in the Chisos Mountains.

***Oxycopis howdeni*, new species**

The fuscus color of this beetle makes it distinctive from other members of the genus except for *O. mariae* (Arnett) to which it is

closely similar, and *O. maculicollis* (Champion) which it closely resembles. It is separated from *O. mariae* by the distance between the eyes in dorsal view; the eyes are more widely set apart in *O. howdeni* and more placed in *O. mariae*. The antennal segments of *O. howdeni* are longer and narrower than those of *O. mariae*. The general color of *O. howdeni* is fuscus, while that of most specimens of *O. mariae* is a dark chestnut, almost piceus; but some specimens may be fuscus. *O. maculicollis* is confined to tropical Central America and has different genitalic characters.

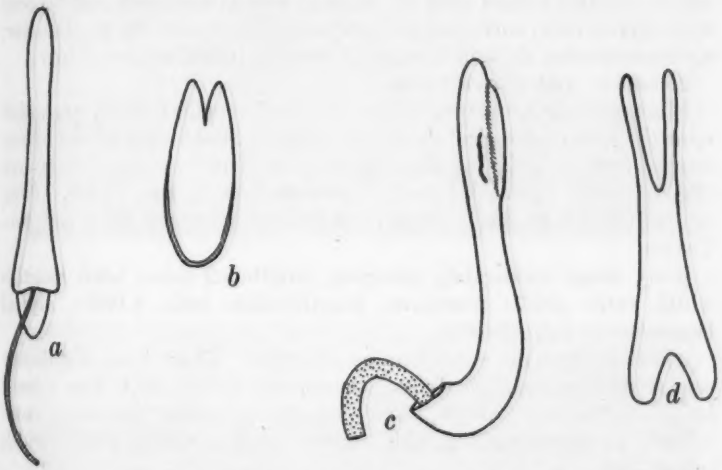


FIGURE 2.—*Vasaces elongatus* Arnett, male: *a*, ventral view of penis; *b*, paramere. *Oxycopis howdeni*, new species, male: *c*, lateral view of penis; *d*, ventral view of paramere.

Holotype: Male, Tornillo Flat, Big Bend National Park, Tex., 3200 ft., May 12, 1959 (collected by Edward Becker and Henry F Howden). Deposited in the U. S. National Museum (type no. 67447).

Description: Head fuscus with mandibles, labrum, and posterior portion of vertex pale; pubescence fine, recumbent, sparse, yellow; punctation coarse, distance between punctures less than the diameter of the puncture, interspaces microreticulate. Antennae with apical segments approximately four times as long as broad, second segment one-half the length of the third. Eyes large, emarginate near insertion of antennae, well separated anteriorly, interocular distance to head length (measured from line across head behind eyes to apex of labrum) ratio 1.9473. Mandibles moderate in length, apices bifid. Maxillary palpi with apical segment cultriform.

Thorax pale fuscus; pronotum with somewhat darker lateral areas which occupy the space from the anterior margin nearly to the base;

pronotal surface with a shallow anterolateral depression on each side and a vague central-posterior depression; pubescence fine, sparse, recumbent, retrose posteriorly, yellow. Pronotal shape obovate with sides convergent posteriorly, somewhat constricted posterior to the center; punctation moderate, space between punctures slightly less than the diameter of the puncture; interspaces microreticulate. Scutellum pale, concolorous with pronotum. Legs fuscus, femora pale except for "knee" area; claws simple.

Elytra fuscus; pubescence fine, recumbent, moderate in density, yellow; elytral costae evident, sutural and lateral area concolorous with elytral disk; surface rugose-punctate, interspaces microreticulate; elytra somewhat flattened, apices rounded, sutural angles obtuse.

Abdomen with sterna fuscus.

Male genitalia agree with those of the genus; penis broadly expanded apically with a subapical dorsal enlargment in the area of the ejaculatory duct (fig.2c); internal sac with evident spicules. Paramere (fig. 2d) with apical bifurcation greater than ⅓ the length. (The figures are not of the holotype, but from a specimen from Del Rio, Texas).

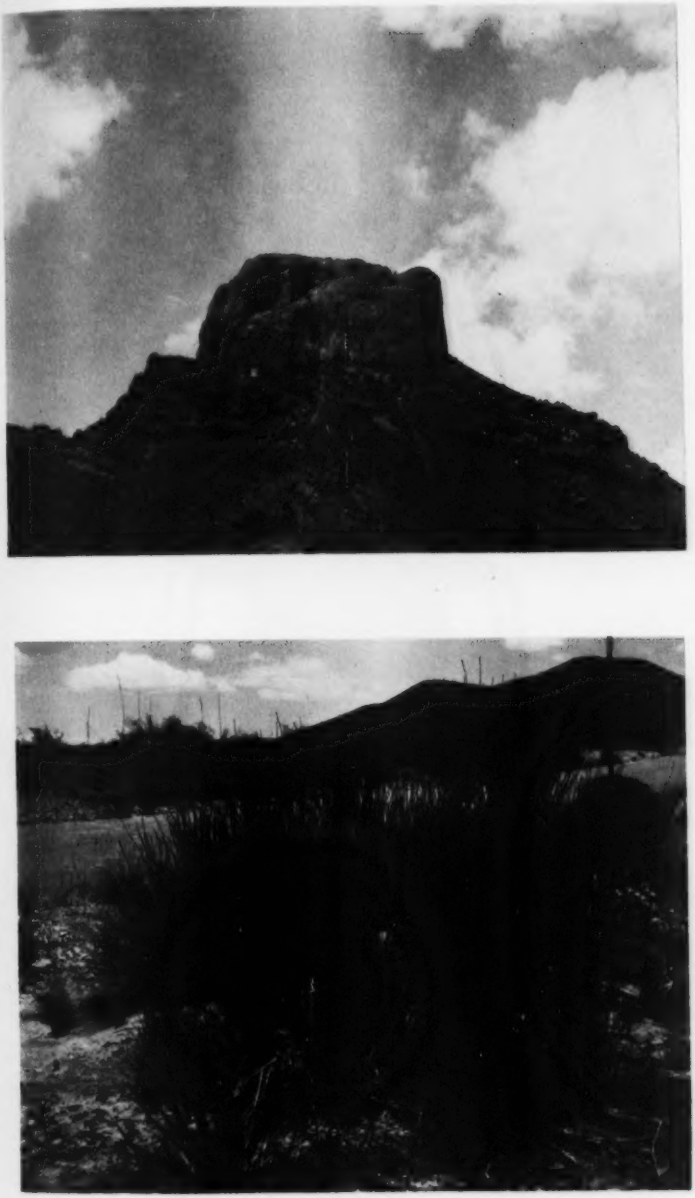
Body shape moderately elongate; length 9.2 mm.; head length/width ratio .8837; pronotum length/width ratio 1.0681; elytral length/width ratio 3.0476.

Allotype: Female, same data as holotype. There is no significant sexual dimorphism. Body measurements: length 10.8 mm.; head length/width ratio .8958; head length/interocular distance ratio 1.9090; pronotum length/width ratio 1.1041; elytra length/width ratio 3.000.

Paratypes: Texas: Del Rio, Apr. 25–26, 1959, 2; Big Bend National Park, Boquillas, May 17, 1959, 2; same data as holotype, 5; same data as holotype except May 20, 1959, 1; Oak Spring, 4000 ft. May 8, 1959, 2; May 22, 1959, 3; Santa Elena, 3200 ft., May 4, 1959, 2; Maverick, 2700 ft., May 4, 1959, 2; Chisos Basin (pl. 4 top), May 19, 1959, 1; May 22, 1959, 1; May 27, 1959, 1 (all collected by Edward Becker and Henry F. Howden.)

Additional specimens examined: In addition to the type series, the following specimens are not made a part of the type series because of the scarcity of specimens and the lack of data to show that they are a part of the type population: Mexico: Tlahualilo, Durango, July 28, 1935, 1 (Texas A. and M. Univ. collection). Texas: Brownsville, 2; Chisos Mts., May 10, 1949, 1 (U.S. Nat. Mus. collection); Starr Co., Mar. 20, 1952, 1; Chisos Mts., May 27, 1959, 1 (Ohio State Univ. collection).

Variation: The color pattern of these beetles is rather distinctive. They resemble somewhat certain populations of *Xanthochroina bicolor*



(Top) Chicos Mts., Casa Grande Peak, type locality of *Vasaces elongatus* Arnett; (bottom) *Euphorbia antisyphilita*, candelilla, on which occurs *Oxacis pallida* (LeConte).

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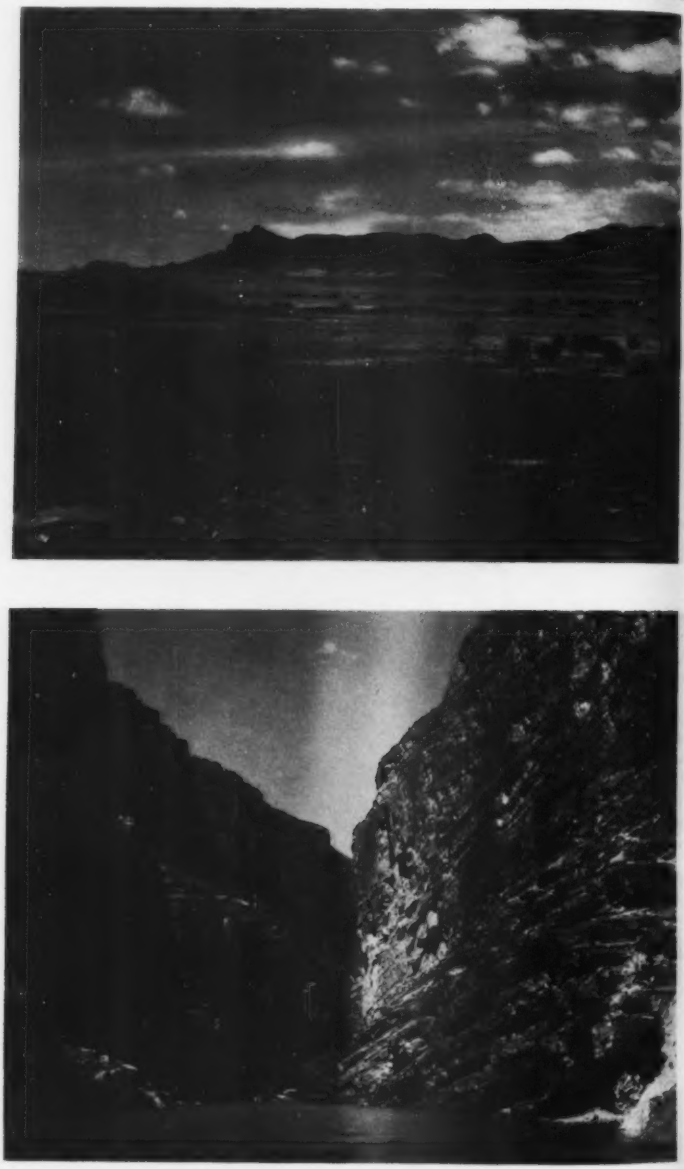
Oxacis subfusca Horn, female.

Oxacis trimaculata Champion, male.



(Top) Desert land near Maverick, type locality of *Oxycopis howdeni* Arnett; (bottom) Santa Elena Canyon, showing the Rio Grande River, with Mexico on the left and United States on the right. The dense vegetation along the river's edge provides the breeding area for *Oxacis trimaculata* Champion, a species usually found in more humid areas.

(LeConte). The darker central spot on the head is confined in most specimens to the interocular area, only rarely extending over a larger area. The paler prothorax varies considerably from specimen to specimen. In a few the prothorax is as dark as the elytra. One of the ways to distinguish this species from *Oxycopis mariae* (Arnett)

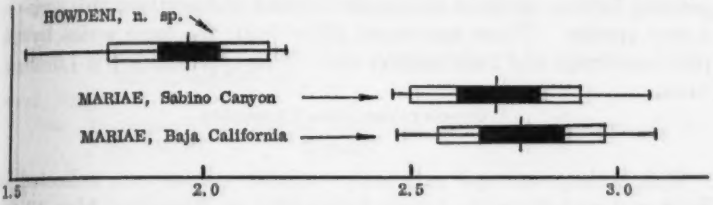


FIGURE 3.—Interocular distance ratio of *Oxycopis howdeni*, new species, and two populations of *O. mariae* Arnett (horizontal line=range of variation; vertical line=mean; black part of bar=two standard errors of standard deviation on either side of mean; one-half of each black bar plus white bar at either end=one standard deviation on either side of mean).

is by the wider interocular distance. The variation of this distance was studied statistically and is found to be significant. The statistical differences between *O. howdeni* and *O. mariae*, so far as this character is concerned, are compared in figure 3.

Oxacis pallida (LeConte)

Some of the 26 specimens of this species were taken on candelilla (*Euphorbia antisyphilitica*) (pl. 1, bottom) and others at light at the Boquillas area, May 17–23. This species is very common throughout the arid regions of the United States. It also occurs in Sonora and probably in Chihuahua.

Oxacis subfusca Horn

PLATE 2

Only one specimen of this species was collected. It was taken at Boquillas, May 23. The species is usually abundant on prickly poppy blossoms in other areas during late July and August, so perhaps more may be found later in the season.

Oxacis angustata Champion

Although this species was described from four specimens taken at Tehuacan, Puebla, Mexico, I have seen it from Chihuahua and Tamaulipas. It agrees very well with the description and type of the species. Eighty-five specimens were taken as follows: Hot Springs, 1900 ft., May 1–29; Boquillas, 1850 ft., May 13; Oak Spring, 3000 ft., May 24; Panther Junction, 4000 ft., May 28; and Tornillo Flat, 3200 ft., May 12.

***Oxacis barbara* Arnett**

The eighteen specimens of this species collected at Tornillo Flat, 3200 ft., May 5–12, do not agree very well with the type specimens of the species. They do agree with this species better than with any other. I prefer to report this collection of specimens under this name pending further study of the species instead of describing this series as a new species. These specimens differ from the type series by the paler markings and their smaller size. The type locality is Lucedale, Miss.

***Oxacis trimaculata* Champion**

PLATE 3

This widespread and extremely variable species was collected at light and on lechuguilla (*Agave lechuguilla*) at Boquillas, May 13–28, and at light May 14 at Santa Elena Canyon (pl. 4 bottom).

***Oxacis cana* (LeConte)**

Twenty-five specimens of this species were collected as follows: Chisos Basin, May 3–24; Tornillo Flat, May 12; Panther Junction, May 24; Boquillas, May 23; and Santa Elena, May 14.

Summary: A new species is described, *Oxycopis howdeni*, and eight other species are reported from Big Bend National Park. Two of the species, *Sparedrus depressus* and *Oxacis angustata* are recorded in the United States for the first time. These species may be identified by the descriptions and keys in Champion (1889, 1890) and Arnett (1951, 1953, 1961, 1963).

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COPEPOD CRUSTACEANS PARASITIC ON ELASMOBRANCH FISHES OF THE HAWAIIAN ISLANDS

By ALAN G. LEWIS

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COPEPOD CRUSTACEANS PARASITIC ON ELASMOBRANCH FISHES OF THE HAWAIIAN ISLANDS[1]

By ALAN G. LEWIS[2]

Introduction

This is the second of a series of three papers covering the copepod parasites of Hawaiian fishes. The first (Lewis, 1964) deals with the caligoid copepod parasites of Hawaiian acanthurid fishes (surgeon fishes). The third paper (in preparation) proposes to cover the copepod parasites of teleost fishes of the Hawaiian Islands.

The two references to copepod parasites of Hawaiian elasmobranch fishes are of an incidental nature. Wilson (1924) indicated that *Pandarus satyrus* had been taken from specimens of *Prionace glauca* and (Wilson, 1932) that *Pandarus smithii* had been collected from sharks in Hawaiian waters. Because of the wide distribution of many of the host species it is not surprising that only one of the thirteen species here discussed is described as a new species.

[1] This study was supported by a grant (NSF G-24956) from the National Science Foundation.

[2] Assistant Professor of Oceanography, Institute of Oceanography, University of British Columbia, Vancouver, Canada.

Many people and institutions have been of significant assistance in the collection of the material and have assisted in other aspects of the study. The author is grateful to the Central University Research Fund of the University of New Hampshire for the assistance that it provided in the purchase of a Bausch and Lomb Tri-Simplex Micro-Projector, and to the Division of Marine Invertebrates of the Smithsonian Institution for working space and use of the specimen collections and the Wilson Library. Although the people and institutions involved in the collection of the specimens are noted in the description of the species, the author is especially grateful to the U.S. Fish and Wildlife Service, the Hawaii Board of Agriculture (Division of Fish and Game), Lester Zukeran, Samuel Kaolulo and Susumo Kato for the collection of both host and copepod material.

TABLE 1.—*Armature of hypothetical thoracic leg shown in figure 1*

Leg	Margin	Interpodal Plate	Protopodite	Exopodite			Endopodite		
				1	2	3	1	2	3
	outer	S	m, d, b, rb, r	r, D, d, p′	dm, H	pH, fmH, mh, mH	C	c	c, p′, P′, Q
	inner		a, m, b, lsse, s	c, dfH	c, B	Cl, dmH, dH, H	P	c, p, p′	P, dP, mP

METHODS: The external surface, gill cavities, buccal cavity and nasal cavities of the elasmobranch hosts were examined for parasitic copepods. Copepods collected from these regions were killed in either 10 percent formalin or ethyl alcohol and later transferred to 95 percent ethyl alcohol. Specimens to be drawn or dissected were placed in 85 percent lactic acid to clear and soften them, stained with Chlorazol Black E dissolved in 85 percent lactic acid, and placed in benzyl alcohol for final clearing and for dissection and drawing.

Drawings of the entire animal were made from specimens placed in benzyl alcohol and covered with a cover slip. Both a camera lucida and a Bausch and Lomb Tri-Simplex Micro-Projector were used in making these drawings. The appendages and processes were drawn, either in situ on the specimen or removed and mounted using Hoyer's mounting medium or Turtox' CMC–10. Measurements of the copepods and their component parts were made with an ocular micrometer.

In the following figures the ♀ and ♂ signs are used separately under each drawing to indicate a difference between the appendage of the female and that of the male. The female and male symbols are used together (♀ ♂) to indicate similarity of the appendage or process in both sexes. The sex from which the drawing is made is indicated by a line under the appropriate symbol. If only one sex is represented

in the collection and no comparative descriptions or illustrations are given, the male and female symbols are not used.

The terminology used is basically the same as that in Lewis (1964). The terms postantennular adhesion pad, postantennal process, postoral process and postoral adhesion pad imply the position and nature of the structure, not the association of it with any appendage. The

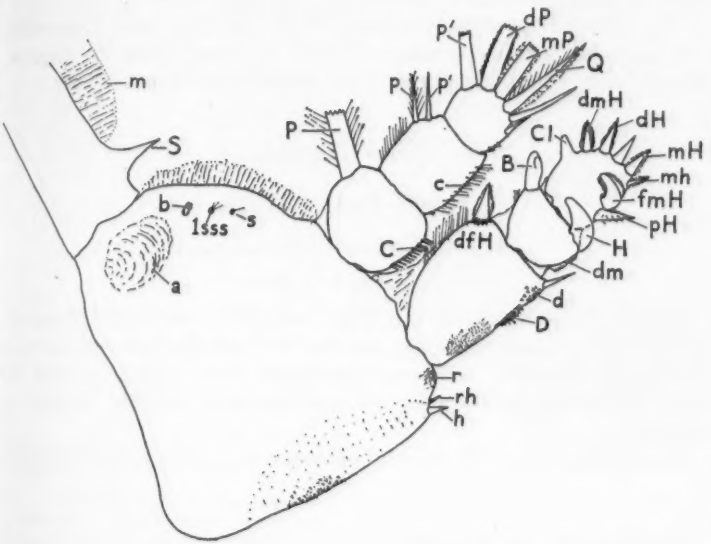

FIGURE 1.—Hypothetical thoracic leg showing various armament components:

a: adhesion pad
B: large bilobed armature element
b: small bilobed membranous process
C: large plumosities
c: small pulmosities
Cl: spikelike extension of segment
D: large denticulations
d: small denticulations
dfH: large spine with frilled membranous margin and denticulations around base
dH: large spine with denticulated membrane along margins
dP: large, denticulated seta
fmH: large spine with frilled membrane along margin
H: large spine
h: small spine
m: membrane
mH: large spine with membranous margin
mh: small spine with membranous margin
mP: large membrane-margined seta
P: large plumose seta
p: small plumose seta
P′: large naked seta
p′: small naked seta
pH: large plumose spine
Q: seta with membrane along one margin, plumosities along other
r: rugose surface
rh: spinule
S: spikelike projection of interpodal plate
s: small hairlike projection
1sss: 3 hairlike projections from same location

author feels that the terms postantennal process and postoral process, as applied to the structures termed first and second maxilla by Wilson (1907a), are noncommittal terms and should be used until the nature of the two structures in question is better understood. To facilitate the use of the thoracic-leg tables, a hypothetical thoracic leg is shown in figure 1, giving all of the component parts of the armament of the thoracic legs discussed in tabular form in the paper. Further, a table of the hypothetical thoracic leg is given in table 1.

The names of previously reported hosts and the hosts from which the Hawaiian specimens were collected are those given by Bigelow, Schroeder and Farfante (1948) or by Gosline and Brock (1960).

Order Caligoida

Family Eudactylinidae

Krøyeria praelongacicula, new species

FIGURES 2*a–j*, 3*a–e*

MATERIAL.—Seven adult females taken by the author from the gill cavity of a *Sphyrna lewini*, captured by Lester Zukeran in Kaneohe Bay, Oahu, Hawaii. Of these 7 specimens, one (USNM 110799) has been designated as the holotype and the rest (USNM 110800) as paratypes.

MEASUREMENTS.—Five adult female specimens (including holotype):

	holotype (*mm.*)	*all five specimens*	
		mean (*mm.*)	*range* (*mm.*)
Greatest length, excluding setae	6.79	7.10	6.58–8.12
Greatest length of cephalothorax	0.88	0.87	0.84–0.88
Greatest width of cephalothorax	0.92	0.95	0.90–1.04
Greatest length of free pedigerous segments	1.06	1.02	0.98–1.06
Greatest length of genital segment	3.80	4.00	3.10–5.00
Greatest width of genital segment	0.55	0.58	0.50–0.65
Greatest length of abdomen	1.28	1.24	1.16–1.28
Greatest width of abdomen	0.28	0.26	0.22–0.28
Greatest length of aciculum	1.30	1.25	1.20–1.30
Length of egg string (1 specimen)			2.75 (27 eggs)

DIAGNOSTIC DESCRIPTION OF FEMALE.—Cephalothorax (fig. 2*a*) ovoid, consisting of cephalic, maxilliped-bearing and first pedigerous segments. Anterior cephalothoracic margin flatly rounded, curving sharply laterally, sharp lateral curve continued posteriorly as distinct line separating raised median cephalothoracic region from narrow, winglike lateral regions. Lateral regions terminating posteriorly in small, lobate extension marking posterior outer corner of small, irregular sinus. Apex of sinus giving rise, ventrally, to single,

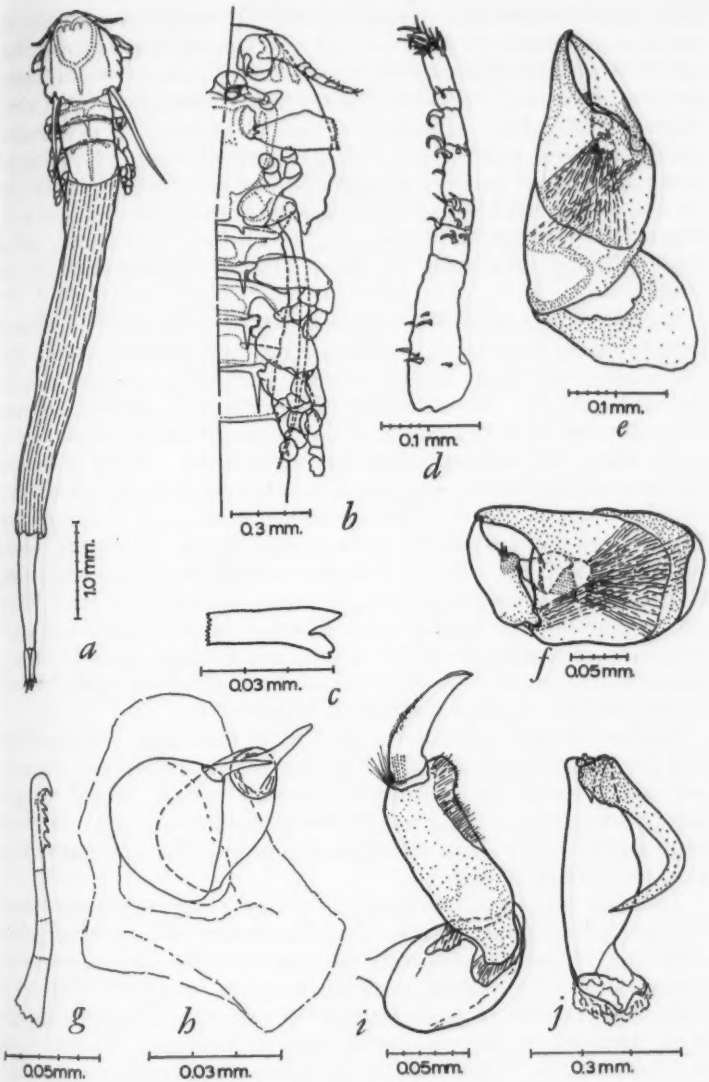

FIGURE 2.—*Krøyeria praelongacicula*, new species, female: *a*, dorsal view; *b*, cephalothorax and free pedigerous segments, ventral view; *c*, tip of aciculum; *d*, left antennule, ventral view; *e*, right antenna, anterior view; *f*, left antenna, anterior view; *g*, left mandible; *h*, right postoral process, ventral view; *i*, right maxilla, posterior view; *j*, right maxilliped, ventral view.

long spikelike aciculum. Aciculum slightly swollen proximally, extending posteriorly to anterior region of genital segment, terminating in irregularly bifurcate tip (fig. 2*c*); inner ramus rounded, outer pointed. Median cephalothoracic region extending posteriorly slightly past lobate extensions of lateral regions. Dorsal median cephalothoracic region with Y-shaped area of heavy sclerotization, arms of Y-angled outward sharply, turning anteriorly and extending to sharply curved lateral anterior cephalothoracic margin then turning medially sharply and extending to median longitudinal axis of body although ramifying to some extent. Ocular elements not visible.

Second, third, and fourth pedigerous segment (fig. 2*b*) free. Second segment more than twice as wide as long, narrower anteriorly than posteriorly, with flatly convex anterior and lateral margins and flat posterior margin. Dorsal region of segment with slender, irregular area of heavy sclerotization extending across anterior end and posteriorly along median longitudinal axis of segment. Third pedigerous segment slightly more than twice as wide as long, anterior region broader than posterior, lateral margins straight or flatly convex. Area of heavy sclerotization present and similar to that of second pedigerous segment. Fourth pedigerous segment slightly wider than long, somewhat less than twice the length of third segment. Posterior region slightly broader than anterior, lateral margins straight anteriorly, irregular or flatly convex posteriorly. Area of heavy sclerotization present, similar to that of preceding segment although lateral portions curving posteriorly sharply.

Genital segment (fig. 2*a*) elongate, more than twice the combined lengths of cephalothorax and free pedigerous segments. Anterior end slightly wider than posterior, convexly curved, lateral margins slightly irregular, posterior margin wavy, almost scalloped. Segment with parallel longitudinal striations due to presence of muscle bands extending length of segment.

Abdomen (fig. 2*a*) 1-segmented, elongate, approximately three-fourths the combined lengths of cephalothorax and free pedigerous segments. Anterior end slightly less than twice the width of posterior, margin almost flat, lateral margins smoothly irregular. Slight but distinct indentation in posterior third of segment. Posterior margin either rounded or flat, lateral to anal indentation. Caudal rami (fig. 3*e*) elongate, length slightly less than 6 times the width. Anterior end concave medially, rounded laterally, lateral margins smoothly irregular although parallel for most of length. Posterior margin rounded, surface bearing 4 large, hook-shaped setae, inner two lightly plumose, larger than outer two. Two additional, hair-

like setules present, one on outer posteroventral surface, one on outer posterodorsal surface.

Antennule (fig. 3*d*) 7-segmented, projecting laterally and posteriorly from ventral anterolateral cephalothoracic surface. First segment

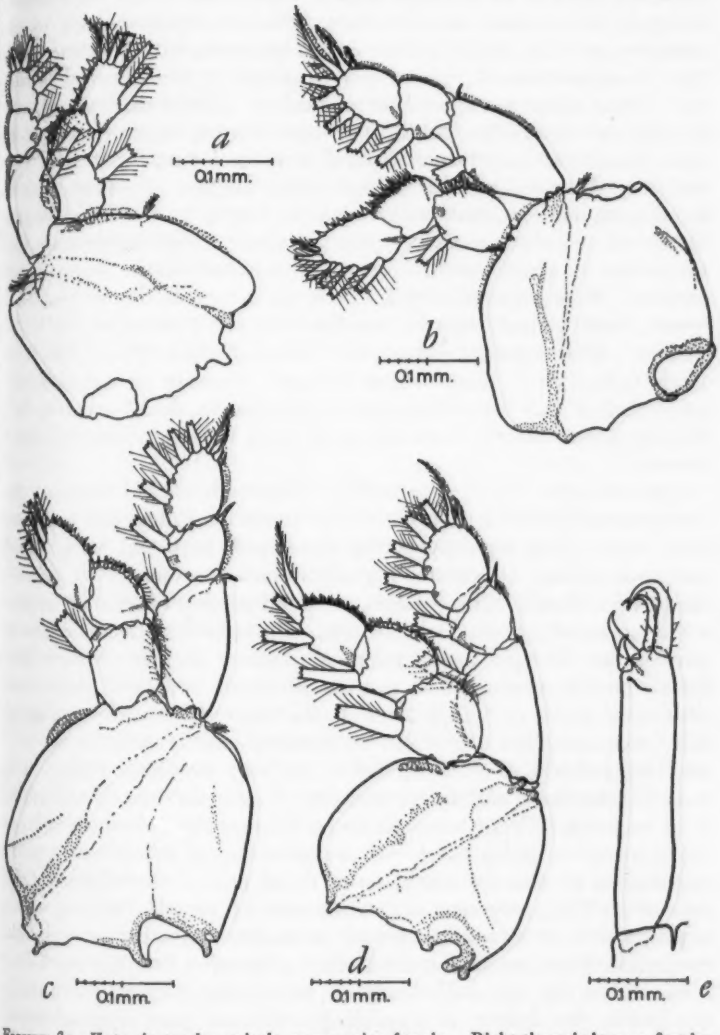

FIGURE 3.—*Krøyeria praelongacicula*, new species, female. Right thoracic legs: *a*, first leg, posterior view; *b*, second leg, anterior view; *c*, third leg, anterior view; *d*, fourth leg, anterior view. Left caudal ramus: *e*, ventral view.

well developed, length slightly less than three-fifths combined lengths of rest of segments, with irregular areas of heavy sclerotization, grooves and other superficial markings in addition to 6 naked setules on proximal half of anterior ventral surface, 1 naked setule on posteroventral surface in proximal region and naked setule (not shown in figure) on median dorsal surface. Second segment short, length slightly less than one-fifth that of first segment, with 1 naked setule from distal portion of anterior lateral surface, 3 from ventral surface and 1 from distal portion of dorsal surface. Third segment approximately two-thirds the length of second, bearing single naked setule from distal portion of anterolateral surface, 4 from ventral surface and 1 (not shown in figure) from distal portion of dorsal surface. Fourth segment approximately equal in length to combined lengths of second and third segments, bearing single naked setule from distal portion of anterolateral surface and 3 naked setules from ventral surface. Fifth segment slightly more than two-thirds the length of fourth, bearing single naked setule from distal portion of anterolateral surface. Sixth segment slightly more than half the length of fifth, with single naked setule from ventral surface. Seventh or terminal segment slightly less than twice the length of sixth, distal end rounded, bearing approximately 13 naked setules and 1 slender, bluntly tipped process.

Antenna (figs. 2*e*, *f*) 3-segmented (although second segment appears separable into 2 parts), attached posterior and medial to antennule base. First segment poorly developed, attached along broad proximal surface to ventral cephalothoracic surface, with distinct indentation distally that receives proximal portion of second segment when segment flexed. Second segment 2-parted (note nature of musculature in figs. 2*e*, *f*), proximal portion slightly shorter than distal, poorly sclerotized in general although with well sclerotized rib-shaped region providing place of attachment for muscles adducting third segment. Distal portion of segment heavily sclerotized, with clawlike projection of inner distal surface; proximal region with heavily sclerotized surface for attachment of broad muscle adducting third segment. Projection from inner distal surface of segment large, terminating in sharp point with winglike lateral extensions forming cup-shaped process for reception of distal end of claw-shaped third segment. Third segment and projection of second forming chela, segment with 2 minute accessory processes, appearing as spikelike projections from proximal inner surface, adjacent to knoblike swelling.

Mandible (fig. 2*g*) indistinctly 4-parted, first part approximately one-fourth the length of appendage. Second part approximately three-fourths the length of first, third part equal to length of first but more slender, with slight taper from proximal to distal regions.

Fourth part approximately one and one-fourth times the length of first, distal end sharply rounded, forming inwardly-directed, hook-shaped process. Fourth part with 4–5 large and several small, toothlike projections on inner margin. Postoral process (fig. 2*h*) consisting of 2 nodules arising from platelike area of heavy sclerotization immediately lateral to mouth cone base; each nodule bearing single, setule-like process distally. Maxilla (fig. 2*i*) 2-segmented, situated lateral and posterior to mouth cone. First segment slightly less than half the length of second; anterior and posterolateral surfaces projecting distally as rounded, lobate processes that articulate in depressions of proximal end of second segment. Second segment more elongate than first, with fan-shaped swelling on inner distolateral surface. Plumosities present on fan as well as ridge leading to it from median inner surface. Outer distolateral corner with small concavity bearing plumosities, plumosities extending around to anterolateral distal surface. Distal end of segment forming articulation surface for large, saber-shaped terminal process bearing frilled membrane along outer surface and flabby, membranous covering around distal end.

Maxilliped (fig. 2*j*) 2-segmented, situated medial and slightly posterior to maxilla base. First segment strongly developed, widest medially, tapering sharply proximally to rounded proximal end, gradually to irregular distal end. Irregular distal surface with V-shaped inner margin, irregularly knobbed anterior and posterior lateral margins and slightly knobbed outer margin. Knobs on both antero- and posterolateral margins articulating in depressions on proximal surface of segment. Second segment incompletely fused with elongate terminal process. Segment and process slightly longer than first segment although segment very short and heavily sclerotized; terminal process long, heavily sclerotized and acuminate, curving sharply inward and posteriorly.

Thoracic legs I–IV biramous, each consisting of 1-segmented protopodite, 3-segmented exopodite and 3-segmented endopodite. Interpodal plate of each leg pair with pair of spikelike projections. For nature of legs and armament, see table 2 and figures 3*a–d*.

Discussion.—*Krøyeria praelongacicula* resembles *K. sublineata* Yamaguti and Yamasu (1959) in the nature of the setation of the thoracic leg endopodites although differing from it primarily in the armament of the rest of the legs as well as in the size of the organism, the nature of the maxilla and aciculum. The bifid aciculum tip of *K. praelongacicula* is found in *K. spatulata* Pearse (1948), although the thoracic leg armature and segment size is different as well as the aciculum length (*K. spatulata* with a shorter aciculum) and the body length relationships (*K. spatulata* with a much longer genital segment than

K. praelongacicula). The diagnostic characteristics of the new species are the setal formula for the exopodite of each of the four pairs of thoracic legs (the total number being 5, 7, 7, 7 for thoracic legs 1–4 respectively), the presence of distinct denticulations on the endopodite of each of the four legs, the length of the aciculum and its peculiarly bifid tip.

TABLE 2.—*Armature of thoracic legs I–IV of the female of* Krøyeria praelongacicula, *new species*

Leg	Surface	Interpodal Plate	Protopodite	Exopodite			Endopodite		
				1	2	3	1	2	3
I	outer	S	p	2m	m	m, mP, P	m	c, 7D	c, 6D, 2P
	inner		m, p, m	m, P	P	3P	P		4P
II	outer	S	p	m, rh	m	m, p, mP, Q, P	m, c	c, 7D	c, 7D, P
	inner		m	c, P	P	3P	P		5P
III	outer	S	p	m, rh	m, h	m, p′, P′ 2P	m, c	c, 7D	c, 9D, P
	inner		m	c, P	P	3P	P		3P
IV	outer	S		rh	m, h	m, p′, mP, Q	m, c	c, 6D	c, 10D, P
	inner		m	c, P	P	4P	P	P	2P

REMARKS.—The name of this species derives from the Latin "praelongus," meaning very long, and "acicula," meaning small needle, both terms descriptive of the extra length of the two needle-like projections from the posterior surface of the cephalothorax.

Family Anthosomatidae

Anthosoma crassum (Abildgaard, 1794)

FIGURES 4*a–h*, 5*a–h*, 6*a–j*

Caligus crassus Abildgaard, 1794, p. 46, pl. 5, figs. 1–3.—Lamarck, 1818, p. 210.

Anthosoma smithii Leach, 1814, pl. 181; 1816, p. 406, pl. 20, figs. 1–6.—Latreille, 1817, p. 198.—Leach, 1819, p. 533.—Latreille, 1829, p. 198.—Burmeister, 1835, p. 328.—Krøyer, 1838, p. 295, pl. 2, fig. 2.—Milne-Edwards, 1840, p. 483, pl. 39, fig. 5.—Guérin-Méneville, 1843, pl. 35, fig. 9.—White, 1857, pp. 124, 323.—Van Beneden, 1870, p. 9.—Richiardi, 1880, p. 5.—Valle, 1880, p. 62.

Caligus imbricatus Risso, 1816, p. 162, pl. 3, fig. 13.—Lamarck, 1818, p. 211.

Caligus smithii.—Lamarck, 1818, p. 210.

Anthosoma crassum.—Latreille, 1825, pl. 335, figs. 11–16.—Gould, 1841, p. 340.—Steenstrup and Lütken, 1861, p. 397, pl. 12, fig. 24.—Stossich, 1880, p. 259.—Rathbun, R., 1884, p. 490.—Carus, 1885, p. 364.—Thomson, 1889, p. 365, pl. 27, fig. 3.—Brian, 1898, p. 5.—Bassett-Smith, 1899, p. 468.—Scott, T., 1905, p. 112, pl. 5, figs. 15–16.—Rathbun, M. J., 1905, p. 97.—Wilson, 1905b, p. 555.—Brian, 1906, p. 62, pl. 3, fig. 1.—Fowler, 1912, p. 477.—Scott and Scott, 1913, p. 108, pl. 23, figs. 5–6.—Wilson, 1922, p. 23, pl. 1, figs. 1–8; 1932,

p. 446, fig. 281.—Leigh-Sharpe, 1933, p. 109.—Yamaguti, 1936, p. 12.—Brian, 1944, p. 208, pl. 5, figs. 43–44.—Fontes, 1949 [paper not seen].—Birkett and Burd, 1952, p. 391, fig. 1 [paper not seen].—Pearse, 1952, p. 28.—Nunes-Ruivo, 1954, p. 19 [paper not seen].—Barnard, 1955, p. 271, fig. 18.—Shiino, 1955c, p. 51, figs. 1–2; 1957, p. 370.—Heegaard, 1962, p. 181.

Otophesia imbricata.—Risso, 1826, p. 136.

REPORTED HOSTS.—*Isurus glaucus, I. oxyrinchus, Carcharias littoralis, Lamna cornubica, L. nasus, Mola mola.*

DISTRIBUTION.—Cosmopolitan.

MATERIAL.—Three ovigerous females and one adult male (USNM 11081) collected by the Hawaii Fish and Game Department from the buccal cavity of a specimen of *Carcharodon carcharias* captured by long line in Pokai Bay, Hawaii. Four other ovigerous female specimens (USNM 11082) taken by E. C. Jones and Kenneth Sherman from the buccal cavity of a "Mackerel Shark" (probably *Isurus oxyrhynchus*) captured at 45°11′N. and 174°54′W., were used as comparative material in the description.

MEASUREMENTS.—Seven female specimens and one male specimen:

	female		*male*
	mean (mm.)	*range (mm.)*	*(mm.)*
Greatest length	11.86	10.85–12.74	10.92
Greatest length of cephalothorax	7.46	6.44– 7.98	6.72
Greatest width of cephalothorax	4.90	4.20– 6.16	3.64
Greatest length of genital segment (5 female specimens)	4.41	3.85– 5.11	2.31
Greatest width of genital segment (5 female specimens)	3.85	3.71– 3.99	1.89
Greatest length of abdomen	0.88	0.70– 0.98	0.70
Approximate length of egg strings (5 female specimens)	20.	17. –30.	

DIAGNOSTIC DESCRIPTION.—Cephalothorax of female (figs. 4*a*, *b*) irregularly ovoid from dorsal viewpoint, irregularity due to constriction of narrow anterior region at approximate division between cephalon and thorax. Dorsal thoracic surface covered by carapace-like structure; structure continuous over cephalon except for indistinct groove at constriction and slight depression with indistinct, incomplete groove at anterior end of cephalon. Cephalothorax consisting of cephalic, maxilliped-bearing and first pedigerous segments. Pair of small, scoop-shaped lappets (fig. 5*b*) present, projecting ventrally and laterally from ventral and ventrolateral cephalothoracic surface at constriction in anterior cephalothoracic region. Structures not associated with either antennules or antennae but may be comparable to postantennular adhesion pads of pandarids and postantennal process of trebiids, euryphorids and caligids. Carapace-like covering of cephalothorax heavily sclerotized, providing hood completely

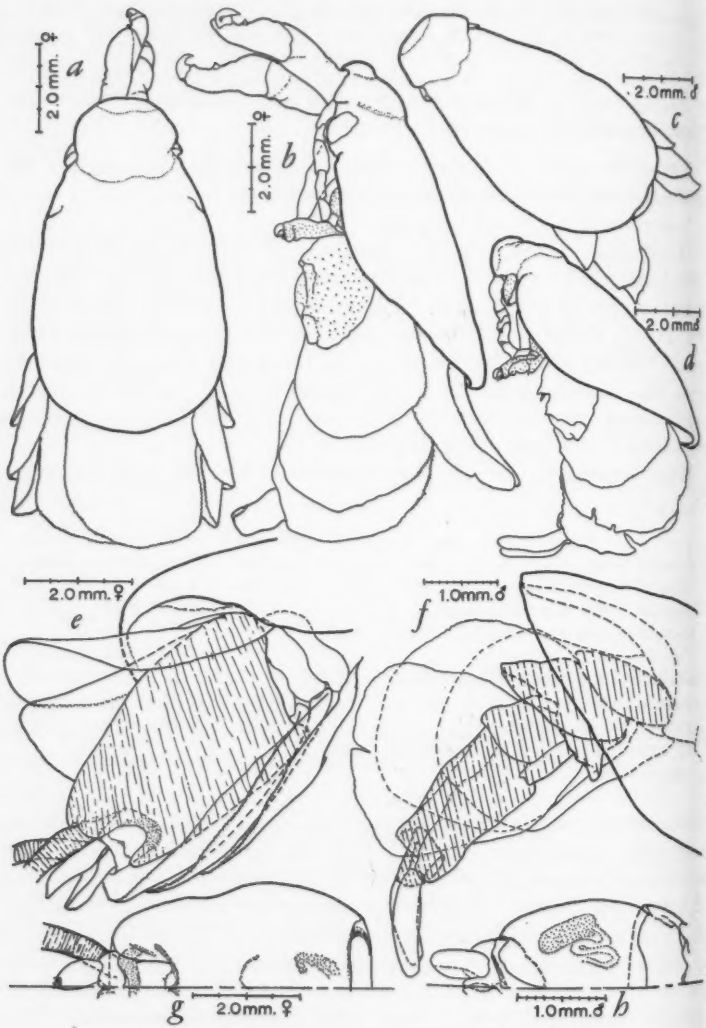

FIGURE 4.—*Anthosoma crassum* (Abildgaard, 1794): *a*, female, dorsal view; *b*, female, lateral view; *c*, male, dorsal view; *d*, male, lateral view; *e*, female, posterior end of cephalothorax, free pedigerous segments, elytra, genital segment, abdomen, caudal ramus;* and egg strings, ventrolateral view; *f*, male, posterior end of cephalothorax, free pedigerous segments, elytra, genital segment, abdomen, and caudal ramus,* ventral view; *h*, male, genital segment, abdomen, and caudal ramus,* ventral view. (*Apparent differences in length and shape of the caudal ramus are due to the angle at which the figure was drawn; see figure 5*a*.)

covering dorsal and lateral surfaces and projecting ventrally below ventral surface of body as well as posteriorly, over free pedigerous segments.

Although first pedigerous segment considered fused with cephalothorax, indistinct indication of anterior margin present as inverted, V-shaped region of heavy sclerotization between and slightly posterior to maxilliped bases. Second and third pedigerous segments narrow, appearing ringlike from ventral viewpoint. Single pair of plates or elytra present on second pedigerous segment, arising from ventrolateral, lateral, and dorsal surface, projecting posteriorly well past posterior end of carapace-like cephalothoracic covering. Surface of elytra similar to that of thoracic legs, covered with minute, knoblike regions of heavy sclerotization and margined by minute denticulations. Status of fifth thoracic segment (= fourth pedigerous segment if legs were present) uncertain; Shiino (1955c) indicates it is fused with the genital segment but specimens examined for this description indicate that although it is coalesced posteriorly and separable from the genital segment only by an indistinct, incomplete line of division, it does project slightly and is similar to the preceding 2 segments. This segment fits into an indentation in the anterior end of the genital segment and is partially or completely covered by the swollen genital segment (fig. 4*e*).

Genital segment (fig. 4*g*) swollen, lateral margins smoothly biconcave, posterior margin flatly rounded dorsally, irregular ventrally, segment overlapping abdomen laterally and dorsally. Abdomen 1-segmented, irregular, norrower anteriorly than posteriorly although posterior end slightly swollen, with heavily sclerotized band around posterior margin. Proximal ends of caudal rami forming segment-like structure, inner surfaces V-shaped and forming tubelike extensions of proctodaeum. Distal half of each ramus narrower than proximal, from dorsal viewpoints, inner lateral surface convex. Outer mediolateral surface, dorsal surface, and ventral surface with row of spikelike processes that barely break through cuticle, distal end of ramus with concentration of processes, giving thorny appearance (fig. 5*a*).

Cephalothorax of male (figs. 4*c*, *d*) similar to that of female. Free pedigerous segments larger; second pedigerous segment and part of third covered dorsally by carapace-like cephalothoracic covering. Second and third pedigerous segments short, disk-shaped from ventral viewpoint, each with platelike cuticle dorsally, extending posteriorly over part of succeeding segment. Second pedigerous segment without elytra present in female. Fifth thoracic segment incompletely fused with genital segment, division apparent as irregular, incomplete groove and line of heavier sclerotization; segment covered dorsally by plate-

like formation of dorsal cuticle. Genital segment (figs. 4*f*, *h*) approximately equal to combined lengths of three free thoracic segments, lateral margins flatly concave, dorsal posterior surface flatly concave, ventral posterior surface with V-shaped incision, apex of V at anterior end of abdomen, lateral surfaces of V covering most of ventral abdominal surface. Abdomen 1-segmented, broader anteriorly than posteriorly. Caudal rami slightly longer than in female, without expanded proximal region.

Antennule (fig. 5*c*) of female and male 6-segmented, attached to ventral cephalothoracic surface just inside anterolateral corner of hood-shaped cuticular covering of cephalon and just anterior to scoop-shaped ventrolateral projections. First segment approximately one-third the total appendage length, slightly swollen proximally and distally, with single, setule-like process on distal inner surface. Second segment approximately one-sixth the appendage length, narrow proximally, flaring somewhat irregularly distally to broad distal end, with minute, spikelike process on inner medial surface and small setule just distal to it. Third segment approximately one-eighth the appendage length, varying little in width. Fourth segment approximately one-sixth the appendage length, narrow proximally, flared slightly towards slightly swollen distal end. Fifth segment approximately one-eighth the appendage length, slightly wider distally than proximally, with minute spike on distal inner surface. Sixth segment short, length approximately one-twelfth that of appendage, slightly wider distally than proximally distal surface rounded, bearing approximately 6 minute, stiff, setule-like projections from inner surface, 4 from medial surface and single, small, spikeline projection from outer surface.

Female antenna (fig. 5*d*) 4-segmented, not 5 as Shiino (1955c) indicates. Proximal half of appendage capable of being withdrawn into deep socket in ventral surface of cephalothorax just medial and slightly posterior to antennule base (fig. 5*b*) but proximal end of appendage with flexible arthrodial membrane that may appear segment-like (see fig. 5*d* for depiction of musculature). First segment approximately one-third the appendage length, relatively narrow although slightly swollen proximally and distally, distal margin irregular. Second segment slightly more than one-fourth the appendage length, angled proximally and distally, overlapping outer surface of first and third segments. Exact nature of second segment questionable due to rather indistinct break between adjacent segments although musculature apparently associated with segment and adjacent segments suggests the term segment is applicable. Third segment slightly more than one-third the appendage length, larger proximally than distally, inner surface with large, roughened, spike-shaped projection medially. Irregular distal margin angled proximally from outer to inner lateral

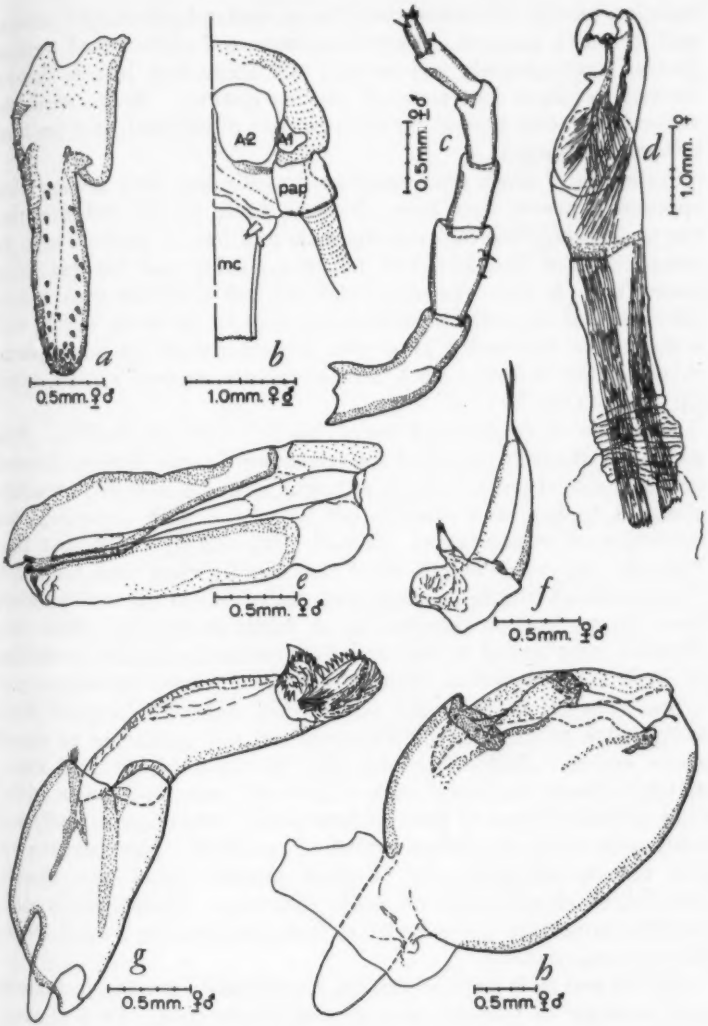

FIGURE 5.—*Anthosoma crassum* (Abildgaard, 1794), female and male: *a*, right caudal ramus, ventral view; *b*, oral and preoral region, ventral view, showing antennule (A–1), antenna (A–2), postantennular process (pap), mouth cone (mc), and postoral process; *c*, right antennule, ventral view; *d*, right antenna, lateral view (irregular lines depict muscles); *e*, mouth cone and right mandible, lateral view; *f*, right postoral process, lateral view; *g*, right maxilla, posterior view; *h*, right maxilliped, anterior view.

margins, heavily sclerotized medially to receive knob-shaped proximal end of fourth segment. Fourth segment and claw-shaped terminal process approximately one-seventh the appendage length, division between segment and terminal process distinct. Single, setule-like accessory process present on inner surface of segment, just proximal to terminal process.

Antennae of single male specimen in collection both broken when specimen removed from host. Shiino's figure (1955c) indicates that the major difference between the male and female antenna is in the composition of the third and fourth segments and his description states (ibid., p. 56): "Terminal claw of 2nd antennae with a short falciform and a rounded protuberances close to the base, besides with a short seta; succeeding joint with 2 similar setae on inner margin in the region between apex and acuminate process against which tip of claw acts."

Mandible of female and male (fig. 5*e*) 3-parted, rodlike. First part approximately one-third the appendage length, division between first and second parts distinct, complete although second part solidly attached to first and musculature associated with appendage not indicative of segmentation. Second part slightly more than two-fifths the appendage length, third part slightly more than one-fourth the appendage length, proximal end angled, distal rounded although inner lateral portion terminating in toothlike process; distal two-thirds of inner lateral surface with 17 large denticulations in addition to single denticulation at junction of distal and inner lateral margins.

Scoop-shaped postantennal process (fig. 5*b*) with irregular distal margin due to minute, rodlike structures not appearing to extend above cuticle. Postoral process (fig. 5*f*) 2-parted, situated immediately adjacent to lateral surface of mouth cone, both parts arising from platelike region of heavy sclerotization extending medially and continuous with articulation surface of mandible. First part of postoral process semitriangular in cross section, distal end sharply rounded, bearing 2 naked, setule-like structures. Second part a small, knoblike projection just anterior to first part, bearing 3 small setule-like processes distally.

Female and male maxilla (fig. 5*g*) 2-segmented, situated just lateral and posterior to postoral process and mouth cone. First segment slightly shorter than combined length of second segment and terminal process, although better developed. Distal margin of first segment irregular, with sinus on outer posterior surface that receives heavily sclerotized outer proximal end of second segment; outer distal surface with small clump of plumosities. Outer surface of second segment with membrane along distal half and spike-shaped protrusion from distal region in addition to denticulated expansion of distal end of

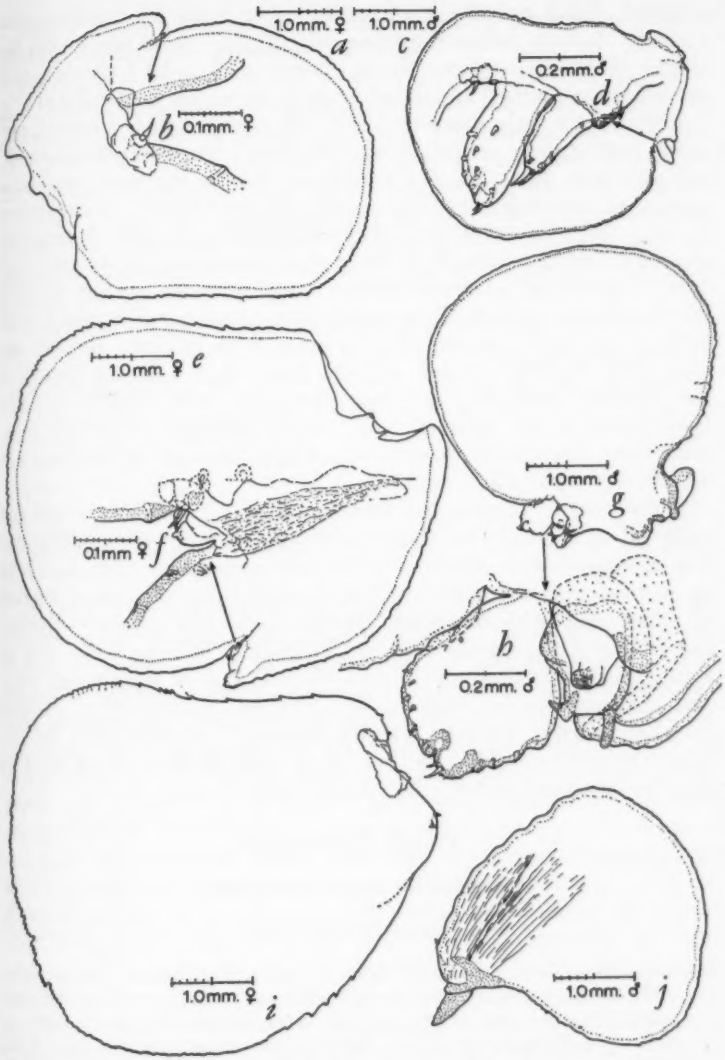

FIGURE 6.—*Anthosoma crassum* (Abildgaard, 1794), right thoracic legs: *a*, female, first leg, posterior view; *b*, female, enlarged view of notch in first leg, posterior view; *c*, male, first leg, posterior view; *d*, male, enlarged view of notch in first leg, showing rami, posterior view; *e*, female, second leg, posterior view; *f*, female, enlarged view of notch in second leg, posterior view; *g*, male, second leg, posterior view; *h*, male, enlarged view of notch in second leg, showing rami, posterior view; *i*, female, third leg, posterior view; *j*, male, third leg, posterior view.

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segment, distal end also with tuft of plumosities on posteromedial surface. Lobate terminal process slightly less than one-fourth the length of second segment, inner surface puffy and irregular, with minute ridges; lateral and distal margins of process denticulated.

Female and male maxilliped (fig. 5*h*) 2-segmented, situated posterior and slightly medial to maxilla base. First segment well developed, with long, heavily sclerotized, lobate proximal projection serving as articulation and muscle attachment surface. Inner surface of segment with distinct, heavily sclerotized, steplike indentation medially that bears single, spike-shaped protrusion on anterior surface. Distal half of inner surface irregular, with groove that receives terminal process of second segment when segment flexed; with knob-shaped adhesion surface just anterior to groove. Second segment and terminal process slightly more than half the length of first segment, excluding proximal projection, with slightly swollen, heavily sclerotized proximal end. Second segment distinctly separable from claw-shaped, heavily sclerotized terminal process in male, indistinctly separable in female.

Three pairs of thoracic legs present (figs. 6*a–j*) in both female and male, all with greatly enlarged, plate-shaped protopodite. Protopodite margined with minute, rod-shaped projections (not shown in figures) reaching to or just breaking through cuticle. Dorsal surface of protopodite with scattered, circular spots (not shown in figures) and rod-shaped processes scattered irregularly between spots and on ventral surface. First and second thoracic legs of female and male with distinct sinus on inner lateral surface, sinus bearing distinct evidence of rami (exopodite and endopodite) in male (figs. 6*d*, *h*), indistinct evidence in female (figs. 6*b*, *f*). Third thoracic leg without sinus and evidence of rami, in both male and female.

Family Pandaridae

Pandarus satyrus Dana, 1849

FIGURES 7*a–d*, 8*a–f*, 9*a–e*

Pandarus satyrus Dana, 1849, p. 59; 1853, p. 1367, p. 95, fig. 2a–c.—Brady, 1883, p.134.—Bassett-Smith, 1899, p. 467.—Wilson, 1907b, p. 415, pl. 31, figs. 162–171; 1914, p. 71, pl. 15, figs. 1–8; 1924a, p. 213.—Yamaguti, 1936, p. 5, pl. 3, fig. 36, pl. 4, figs. 37–41.—Shiino, 1954c (in part), p. 312, figs. 11–17; 1957 (in part?), p. 364; 1959a (in part?), p. 315; 1959b (in part?), p. 352; 1960 (in part), p. 493.

Pandarus zygaenae Brady, 1883, p. 134, pl. 55, fig. 3.

REPORTED HOSTS.—*Prionace glauca*, *Zygaena malleus* (=*Sphyrna zygaena*, in part, and *Sphyrna diplana*, in part). (The hosts reported by Shiino have not been included.)

DISTRIBUTION.—Kermadec Islands, Cape Verde Island, Gulf of Mexico, Japan, Hawaii, eastern Pacific.

MATERIAL.—Thirteen adult females (USNM 110803) taken by E. C. Jones and Kenneth Sherman from the external surface of a specimen of *Prionace glauca* captured by longline at 40°15′N., 170°16′W. Although this is far removed from the Hawaiian Islands, the species is included here because of the frequent occurrence of *Prionace glauca*, the principal host (Cressey, in correspondence), around the Hawaiian Islands (Gosline and Brock, 1960) and the report of the copepod from the Hawaiian Island region by Wilson, (1907b, 1924b).

MEASUREMENTS.—Thirteen female specimens:

	mean (mm.)	*range(mm.)*
Greatest length	8.57	7.77–9.24
Greatest length of cephalothorax	4.15	3.71–4.41
Greatest width of cephalothorax	4.28	3.92–4.55
Greatest length of genital segment	2.65	2.17–4.07
Greatest width of genital segment	2.93	2.59–3.15
Greatest length of anal lamina (12 specimens)	2.02	1.82–2.38
Greatest length of caudal ramus	0.91	0.70–1.19
Length of egg string (5 specimens)	4.41	3.78–5.74

DIAGNOSTIC DESCRIPTION OF FEMALE.—Cephalothorax (fig. 7*a*) consisting of cephalic, maxilliped bearing and first pedigerous segments, narrower anteriorly than posteriorly, greatest length slightly more than greatest width. Lateral margins flatly convex, with narrow, denticulated membrane along anterior portions; posterior margin irregularly concave, median half irregularly denticulated. Frontal region narrow, with distinct median depression between incompletely fused frontal plates, each frontal plate with dark brown to black ovoid area of pigmentation. Second, third and fourth pedigerous segments incompletely fused ventrally, distinguished dorsally by plates arising as extensions of tergites. Second through fourth pedigerous segments (fig. 7*b*) each with median plate, that of third more than twice the length of second, with median sinus posteriorly, that of fourth approximately one and two-thirds the length of third, with median sinus posteriorly. Second pedigerous segment also with pair of plates originating lateral to median plate, extending laterally and posteriorly on dorsal surface and anteriorly underneath posterior lateral cephalothoracic region to form large, ridged adhesion pad (fig. 7*c*). Plate of fourth pedigerous segment overlapped anteriorly by plate of third pedigerous segment and overlapping anterior half of genital segment.

Genital segment (fig. 7*c*) broader anteriorly than posteriorly, lateral margins flatly convex in anterior two-thirds of segment, sharply concave

in posterior third, posterolateral corner forming knob-shaped projection tipped by single spinule. Posterodorsal surface of segment sharply concave, forming articulation surface for large, oval anal lamina

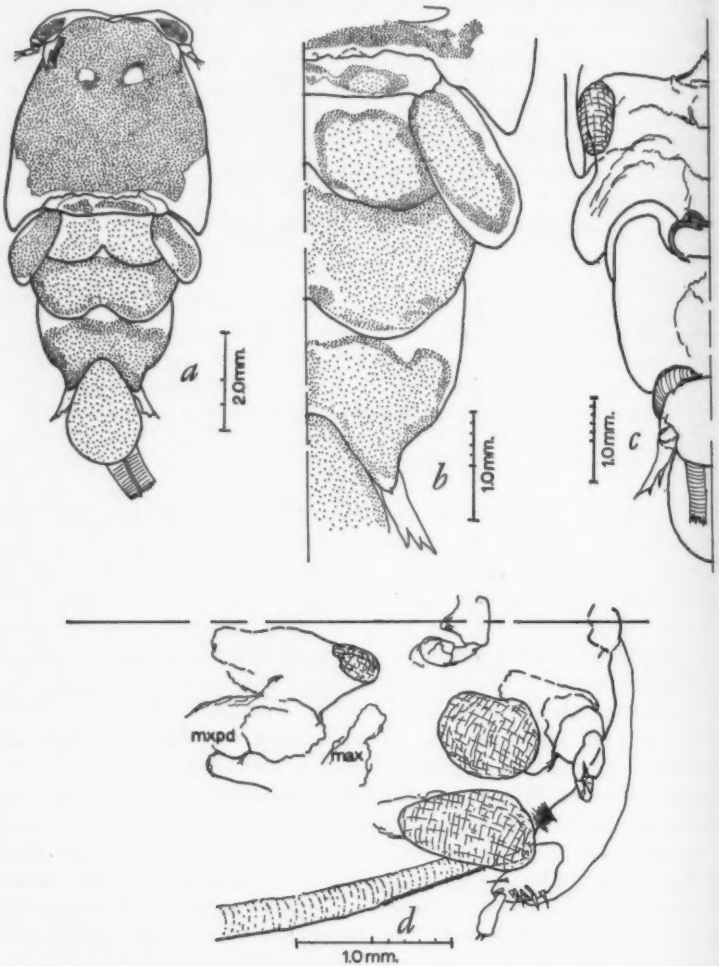

FIGURE 7.—*Pandarus satyrus* Dana, 1849, female: *a*, dorsal view; *b*, postcephalothoracic region, dorsal view; *c*, postcephalothoracic region, ventral view; *d*, pre- and postoral adhesion pads, ventral view.

extending posteriorly well past caudal rami. Abdomen 1-segmented, extending posteriorly, from posteroventral surface of genital segment, slightly past posterior end of knoblike protusions of genital segment.

Lateral abdominal margins convex anteriorly, concave posteriorly, posterior margin biconvex. Caudal rami large, heavily sclerotized, spiniform, arising from concave posterior lateral abdominal surface, extending posteriorly and laterally; ramal surface of attachment narrow.

Cephalothorax dark brown to black dorsally except for posterolateral corners, median portion of frontal region, pair of rounded areas in ocular region and scattered, minute spots. Median plate of second pedigerous segment with light brown pigmentation over most of surface, lateral plates of segment dark brown to black except along extremities. Median plate of third pedigerous segment with pair of large, dark brown to black pigmented areas, one on either side of plate. Fourth pedigerous segment dark brown to black except for margins and for anterior surface, under plate of third pedigerous segment, in addition to pair of small, orbicular areas at apex of indentation of median posterior margin. Genital segment dark brown to black over most of posterior half, anal lamina also dark brown to black except along posterior margin.

Antennule (figs. 7*d*, 8*a*) 2-segmented, situated at lateral junction of cephalothorax and frontal region. First segment approximately 3 times the length of second, broader proximally than distally, ventroanterior and anterior surface with 21 naked and lightly plumose setules, ventrodistal surface with 7. Second segment club-shaped, medial posterior surface with 1 naked setule, distal surface with approximately 9. Antenna (fig. 8*b*) 3-segmented, first segment with closely associated, oval adhesion pad extending anteriorly and ventrally. Some indication present (grooves, lines of sclerotization) indicating process may not be part of antenna although evidence indistinct and contradictory evidence (continuation of heavily sclerotized basal ridge with first segment, nature of the musculature) suggesting that adhesion surface an extension of segment. First antennal segment, excluding adhesion pad, short, well developed, irregularly tapered from proximal to distal end. Second segment slightly more than four-fifths the length of first, width slightly greater than length, outer surface bilobed and compressed. Third segment less than half the width of second, short, bearing hook-shaped terminal process, distinct from segment, and 2 setiform accessory processes, 1 from proximal posterior surface, second from distal inner surface, at junction of segment and terminal process.

Mandible (fig. 8*c*) 2-parted although indistinct evidence of division in distal half of second part; distal region of second part flattened, rounded distally, with 9 denticulations on inner surface. Postantennular adhesion pad (figs. 7*d*, 8*a*) large, oval, situated just posterior to antennule base. Postoral process (figs. 8*c*, *d*) situated immediately

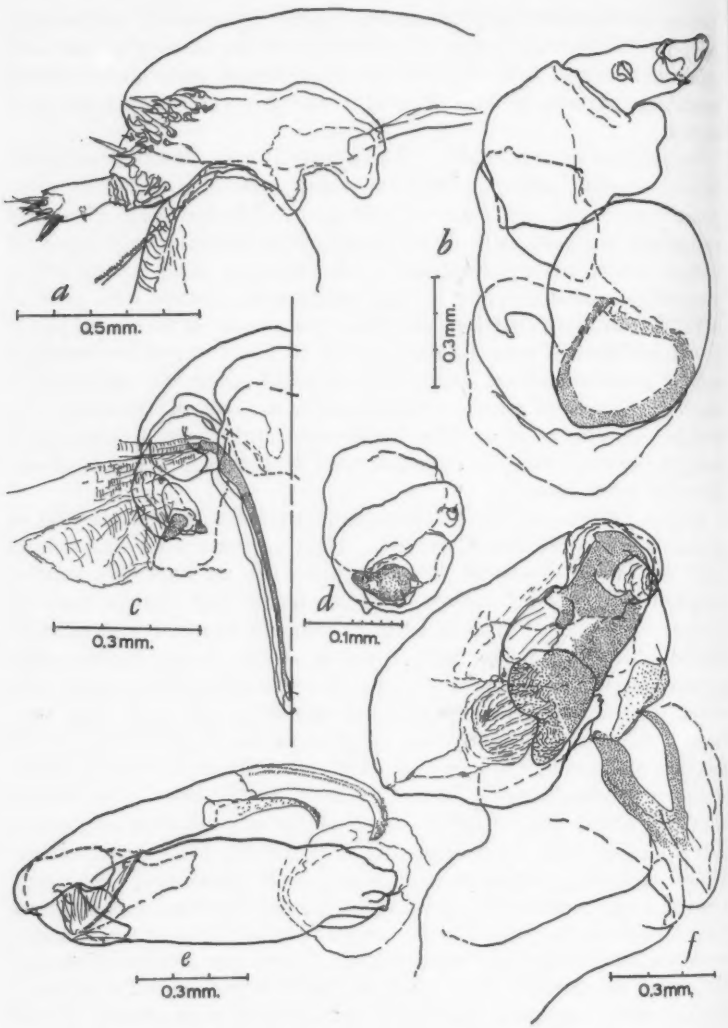

FIGURE 8.—*Pandarus satyrus* Dana, 1849, female: *a*, right antennule, postantennular adhesion pad, and frontal region, ventral view; *b*, left antenna, posterior view; *c*, mouth cone, mandible, and postoral process, ventral view; *d*, right postoral process, ventral view; *e*, right maxilla, ventral view; *f*, right maxilliped, ventral view.

posterior and lateral to mouth cone base, as extension of platelike formation forming attachment and articulation surface for mandible. Postoral process 3-segmented, first and second segments of approximately equal width although first somewhat longer than second and second bearing minute knob on anterior and another on posterior distal surface, anteriormost knob (at least) with spinule. Third segment somewhat narrower than second or first, ovoid in dorsal view, with distinct, marginally denticulated spine distally and small, knoblike accessory process at base of spine. Pair of ovoid adhesion pads (fig. 7*d*) present posterior to mouth cone and postoral process, just medial to maxilla base, at anterior end of heavily sclerotized ridge associated with maxilliped base. Maxilla (fig. 8*e*) 2-segmented, first segment slightly less than one and one-half times the length of second, excluding terminal processes, more strongly developed. Second segment slender, with 2 saber-shaped terminal processes, each with numerous, stiff plumosities.

TABLE 3.—*Armature of thoracic legs I–IV of the female of* Pandarus satyrus *Dana, 1849*

Leg	Surface	Interpodal Plate	Protopodite	Exopodite		Endopodite	
				1	2	1	2
I	outer inner		s, p d, d, p, (d)*	dH	d, 3dH, B 3dP	a	d 3dP, d
II	outer inner	d	1ssss, d, p a, d, s, (d, a)*	d, dH	d, 2dH, d 7H, d, dH	d	d, 2h d, 2H
III	outer inner	d	s, d, p s, s, d, s, (d, a)*	2s, d, H	d, d, 2h, H 3H	d	d, H H
IV	outer inner		r, 2s, d, p a, d, s, (d, s)*	d, H, d, d, 2h, 2H H		d, d	

*Armature elements in middle of segment.

Maxilliped (fig. 8*f*) 2-segmented, first segment irregular although of general triangular outline from lateral viewpoint, with adhesion pad on posterodistal surface. Second segment smaller than first, irregular, with knoblike projection from anterior distal surface and bilobed terminal process projecting posteriorly over part of first segment adhesion pad when second segment flexed. Terminal process lightly rugose, inner lobe longer than outer; single, hairlike accessory process present on second segment, underneath terminal process.

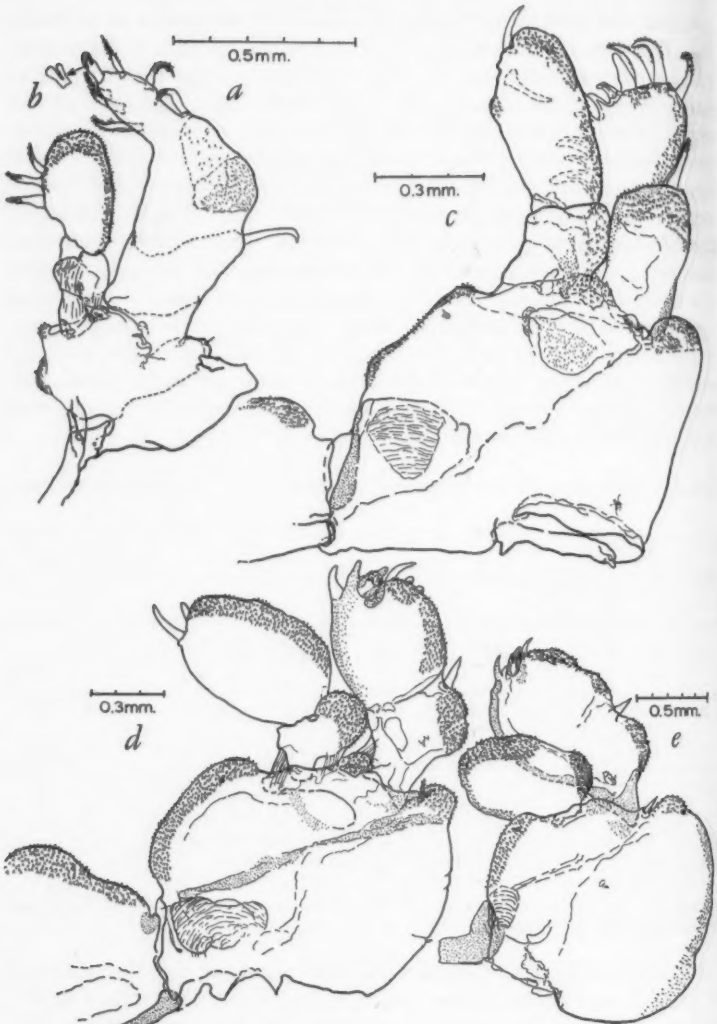

FIGURE 9.—*Pandarus satyrus* Dana, 1849, female: *a*, right first thoracic leg, anterior view; *b*, terminal process of exopodite rotated 90° from figure 9*a*; *c*, right second thoracic leg, anterior view; *d*, right third thoracic leg, anterior view; *e*, right fourth thoracic leg, anterior view.

All four pairs of thoracic legs (table 3, figs. 9*a–e*) biramous, protopodite 1-segmented although superficial division of posterior surface frequently giving 2-parted appearance; some indication of fusion present in rami. Exopodite of first thoracic leg 2-segmented and boot-shaped although segmentation indistinct and evidence of fusion of segments present; distal end of second segment bearing toe-shaped armature element although shape due to folding of bilobed element (fig. 9*b*). Exopodite of second thoracic leg 2-segmented although indication of segment fusion present. Exopodite of fourth thoracic leg 1-segmented although indistinct suggestion of fusion evidenced.

Pandarus cranchii Leach, 1819

FIGURES 10*a–g*, 11*a–k*, 12*a–f*, 13*a–d*

Pandarus cranchii Leach, 1819, p. 535.—Demarest, 1825, p. 339.—Steenstrup and Lütken, 1861, p. 390, pl. 11, fig. 22.—Brady, 1883, p. 133.—Rathbun, R., 1884, p. 488; 1886, p. 317, pl. 5, fig. 1.—Wilson, 1907b, p. 403, pl. 28; 1908, p. 453.—Brian, 1908, p. 4; 1912, p. 14, pl. 3, fig. 1.—Fowler, 1912, p. 479.—Wilson, 1932, p. 435, fig. 273.—Pesta, 1934, p. 30, fig. 21.—Wilson, 1935, p. 333, pl. 5, figs. 58–70, pl. 6, fig. 71.—Heegaard, 1943, p. 27, figs. 76–78.

Nogus latreillii Leach, 1819, p. 536.

Pandarus carchariae (?) Leach, 1819, p. 535.—Bassett-Smith, 1899, p. 466.

Pandarus dentatus Milne-Edwards, 1840, p. 469, pl. 38, figs. 19–20.—Thomson, 1889, p. 363.—Bassett-Smith, 1899, p. 466.

Pandarus vulgaris Milne-Edwards, 1840, p. 468.

Pandarus satyrus.—Shiino, 1954c (in part), p. 312, figs. 11–17; 1957 (in part?), p. 364; 1959b (in part?), p. 352; 1959a (in part?), p. 315; 1960 (in part?), p. 493.—Ho, 1963, p. 90, figs. 11–12.

REPORTED HOSTS.—*Carcharinus obscurus*, *C. brachyurus*, *Lamna nasus*. (Other hosts, reported by Shiino, have not been included.)

DISTRIBUTION.—Cosmopolitan.

MATERIAL.—Four adult females and 1 adult male (USNM 110804) collected by Susumo Kato from the external surface of several specimens of sharks captured by longline around Oahu, Hawaii. One adult female (USNM 110805) taken from the external surface of a specimen of *Pterolamiops longimanus*? from the collections of the Honolulu aquarium. One adult male (USNM 110806) collected by Dr. Marietta Voge and Clara MacNamee from the external surface of a specimen of *Sphyrna lewini* captured by Lester Zukeran in Kaneohe Bay, Oahu, Hawaii.

MEASUREMENTS.—Five females and two males:

	female		male
	mean (mm.)	range (mm.)	(mm.)
Greatest length, excluding setae	8.25	7.84–8.68	7.00, 7.49
Greatest length of cephalothorax	4.14	3.92–4.41	3.92, 4.13
Greatest width of cephalothorax	4.46	4.34–4.62	3.71, 3.85
Greatest length of genital segment	2.69	2.24–3.01	1.82, 2.03
Greatest width of genital segment	3.04	2.94–3.15	1.82, 2.10
Greatest length of caudal rami	1.47	1.33–1.61	0.56, 0.56
Greatest length of anal lamina	1.60	1.54–1.68	
Greatest length of abdomen			0.63, 0.70
Greatest width of abdomen			0.49, 0.77
Length of egg string (1 female specimen)		2.94	

DIAGNOSTIC DESCRIPTION.—Cephalothorax of female (fig. 10*a*) consisting of cephalic maxilliped-bearing and first pedigerous segments, wider posteriorly than anteriorly; frontal region narrow, lateral margins sharply rounded. Lateral cephalothoracic margins flatly convex, medial posterior margin convex, lateral regions projecting slightly past medial posterior surface. Eight denticulations present on medial posterior surface. Ocular region visible as smoothly irregular, clear portion in heavily pigmented anterodorsal surface and irregular, darkly pigmented region just anterior to it.

Cephalothorax of male (fig. 10*b*) consisting of cephalic, maxilliped-bearing and first pedigerous segments, widest medially; posterolateral regions extending well past flat-margined medial posterior region. Frontal region narrow, anterior margin wavy, with small median depression. Anterolateral cephalothoracic margins deeply indented, at junction of frontal region and cephalothorax, generally flatly convex posterior to indentation except for slight indentation in middle of lateral margin. Cephalothoracic grooves present, extending anteriorly from each side of junction of cephalothorax and free second pedigerous segment, terminating at indentation of anterior lateral margin. Inner margins of posterolateral cephalothoracic regions with filmy membrane extending medially and dorsally, covering most of sinus formed by lateral cephalothoracic region and lateral margin of second pedigerous segment. Additional membrane present on each side of median posterior region and directed dorsally and posteriorly.

Female second through fourth pedigerous segments (figs. 10*c*, *d*) free, second pedigerous segment visible dorsally as narrow band slightly overlapped anteriorly by posterior median cephalothoracic region, bearing 4 small denticulations and 2 large lateral plates projecting laterally and posteriorly to middle of genital segment. Third pedigerous segment also appearing as narrow band, overlapped medially by posterior end of second pedigerous segment and laterally by

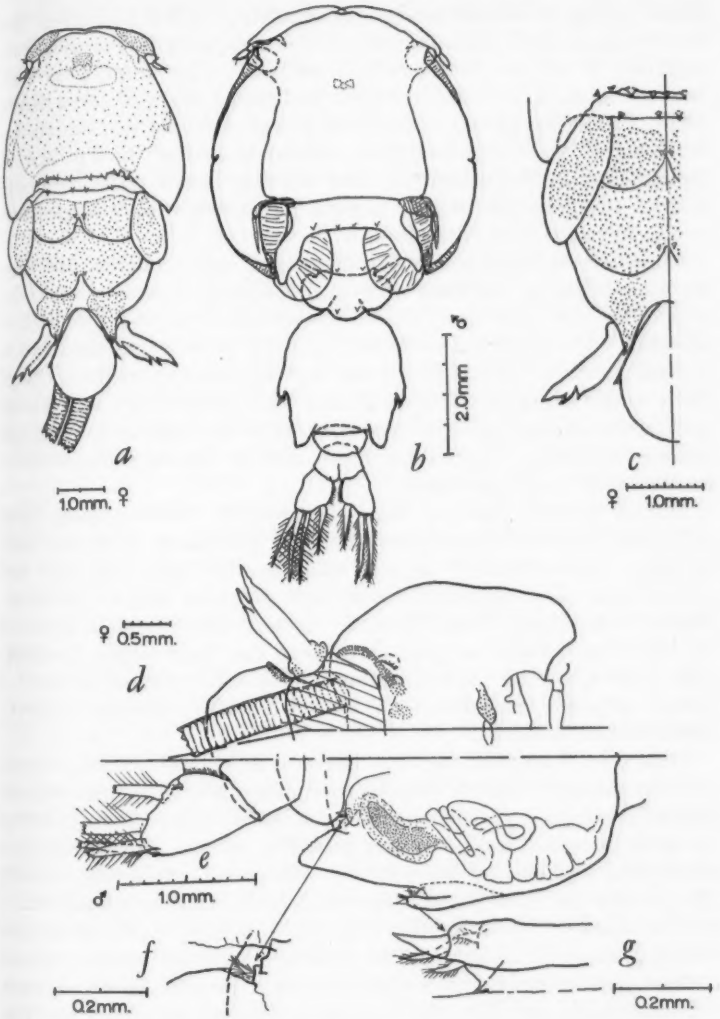

FIGURE 10.—*Pandarus cranchii* Leach, 1819: *a*, female, dorsal view; *b*, male, dorsal view; *c*, female, postcephalothoracic region, dorsal view; *d*, female, postcephalothoracic region, ventral view; *e*, male, genital segment, abdomen, caudal ramus, fifth and sixth legs, ventral view; *f*, male, sixth leg, ventral view; *g*, male, fifth leg, ventral view.

lateral plates of second pedigerous segment. Third pedigerous segment with bilobed, platelike extension overlapping fourth pedigerous segment, 2 minute denticulations medially, just anterior to sinus between lobes of extension. Fourth pedigerous segment also a narrow band, almost completely covered by plates of second and third pedigerous segments, with bilobed plate, similar to that of third pedigerous segment, projecting posteriorly over anterior half of genital segment, pair of minute denticulations present just anterior to V-shaped concavity at junction of lobes of plate.

Male second, third and fourth pedigerous segments (fig. 10*b*) free, second pedigerous segment narrow, with posterolaterally projecting extensions that bear filmy membrane across distal and inner lateral margins. Posterodorsal surface of segment, between extensions, with 4 denticulations. Third pedigerous segment narrow, posterior margin flatly convex, posterodorsal surface with 2 denticulations. Fourth pedigerous segment slightly less than twice as wide as long, lateral surfaces winglike, median posterior margin convex, posterodorsal surface with 2 denticulations.

Female genital segment (fig. 10*d*) roughly heart-shaped, wider anteriorly than posteriorly, posterior end with deep, U-shaped sinus dorsally. Sinus forming place of attachment of large, obovate anal lamina extending posteriorly well past posterior end of abdomen, almost to distal end of caudal rami. Lateral margins of sinus formed by lobate projections of genital segment that bear single denticulation from posterior dorsal surface. Posterior ventral surface of genital segment irregular, with several knoblike regions of heavy sclerotization medially.

Male genital segment (fig. 10*e*) broadest anteriorly, anterior margin convex; posterior lateral regions extending posteriorly past median posterior margin as 2 sharply rounded lobes with minute irregularities on inner margin, dorsal median posterior margin overlapping first abdominal segment. Fifth legs (fig. 10*f*) small, projecting laterally and posteriorly from genital segment margin, bearing spinule and 3 setules distally. Sixth leg (fig. 10*g*) visible only as small spinule and single, plumose setule on padlike swelling of ventral genital segment surface just anterior and medial to lobate projections of segment.

Female abdomen (fig. 10*d*) irregular, narrower anteriorly and posteriorly than medially, at heavily sclerotized articulation surface of caudal rami. Abdomen extending ventrally past anal opening and caudal rami bases as plate-shaped projection with flatly rounded posterior margin. Caudal rami strongly sclerotized, elongate, terminating in sharp, spiniform process and giving rise to 2 additional spiniform processes on dorsal surface, in distal half of rami.

Male abdomen (fig. 10*e*) 2-segmented, first segment shorter than

second, broad anteriorly, convexly rounded posteriorly. Second segment flared to V-shaped posterior end. Caudal rami laminate, inner margin plumose, distal surface with 4 plumose setae and 2 minute setules, 1 on each lateral edge of distal surface.

Color of adult female, in alcohol, dark brown or black over most of dorsal cephalothoracic surface, dorsal plates, posterior end of genital segment and anal lamina, light yellowish brown along margins of body parts and caudal rami. Color of adult male, in alcohol, brown or yellowish brown, without distinctive color pattern.

Female antennule (fig. 11*a*) 2-segmented, attached to lateral ventral surface of frontal region although appearing to articulate, at least partially, in small depression on anterior ventral cephalothoracic surface. First segment slightly more than three times the length of second, with 26 roughened setae on anterior ventral surface in distal half of segment. Second segment slender, width varying little throughout length, distal surface rounded, with 6 short, naked setae anteriorly, 2 short, naked setae medially and 2 posteriorly; additional short, naked seta present on posterior lateral surface just proximal to distal end. Male antennule (fig. 11*b*) 2-segmented, first segment approximately two and one-half times the length of second, distal half with approximately 27 stiffly plumose setules on anterior ventral and distal ventral surface. Second segment club-shaped, with approximately 9 naked setules on distal surface and 1 on distal posterior surface.

Female antenna (fig. 11*c*) 3-segmented, situated medial and posterior to antennule base. First segment irregular, outer lateral and distal margins heavily sclerotized, distal forming articulation surface for second segment. Second segment slightly longer than first, proximal margin irregular, projecting anteriorly as lobate surface articulating in slight irregularity on inside of inner distal lateral surface of first segment. Outer lateral margin with large, knob-shaped swelling, distal margin irregular, posterior portion projecting beyond anterior. Length of third segment and terminal process similar to that of second segment, proximal margin irregular, distal distinct although appearing partially fused with clawlike terminal process. Accessory processes consisting of small, knoblike structure on posterior medial surface of segment and single, setiform process on distal inner surface at junction of segment and terminal process. The antenna appears capable of being projected from or withdrawn into the ventral cephalothoracic surface to some extent, the movement being allowed by a rather flexible arthrodial membrane that, in the fully extended appendage, appears segment-like. Large, obovate pad attached to posterior surface of membrane, extending from cephalothorax to middle of second antennal segment. Pad roughened,

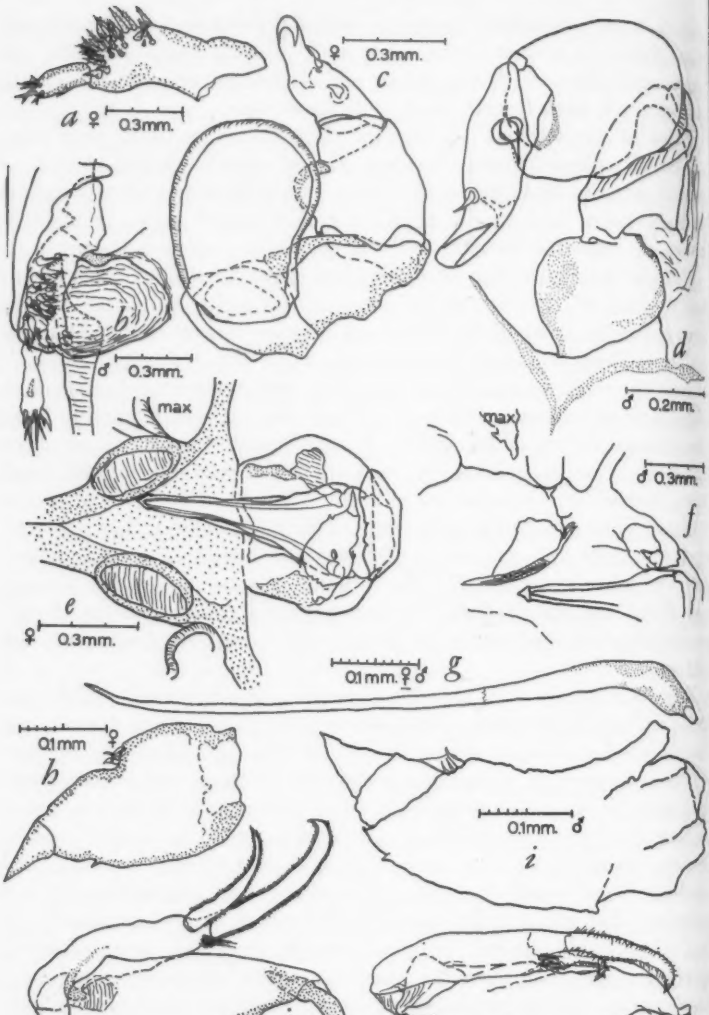

FIGURE 11.—*Pandarus cranchii* Leach, 1819: *a*, female, right antennule, ventral view; *b*, male, right antennule and postantennular adhesion pad, ventral view; *c*, female, right antenna, posterior view; *d*, male, right antenna, posterior view; *e*, female, mouth cone, mandibles, postoral process, postoral adhesion pads, and maxilla bases (max), ventral view; *f*, male, mouth cone, postoral process, postoral adhesion pad, and maxilla base (max); ventral view; *g*, female and male left mandible; *h*, female, left postoral process, posterior view; *i*, male, right postoral process, lateral view; *j*, female, right maxilla, posterior view *k*, male, right maxilla, posterior view.

presumably serving as adhesion pad. Male antenna (fig. 11*d*) 3-segmented, first segment irregular, with slightly ridged adhesion pad, second segment rounded proximally, irregular distally, third segment elongate, with strongly developed, heavily sclerotized, clawlike terminal process in addition to 2 spikelike accessory processes.

Female and male mandible (fig. 11*g*) indistinctly 3-parted, first part short, approximately one-tenth the appendage length, second part slightly less than three times the length of first, broader proximally than distally. Third part longer than combined lengths of preceding parts, tapered slightly towards angled distal region and sharply rounded distal end. Angled distal region with 9 minute denticulations on inner surface. Female postantennular adhesion pad extending posteriorly, from antennule base, past antenna. Male postantennular adhesion pad (fig. 11*b*) paddle-shaped extending laterally from just posterior to antennule base. Female postoral process (figs. 11*e*, *h*) small, palplike, with heavily sclerotized, spikelike terminal process and small, spikelike cuticular projection just proximal to terminal process, on posterior surface, in addition to 3 minute, setule-like processes on indentation of medial anterior surface. Both mandible and postoral process appearing attached to same platelike area of heavy sclerotization. Postoral process of male (figs. 11*f*, *i*) appearing 2-segmented, attached to platelike region of heavy sclerotization on which mandible articulates, first segment approximately 6 times the length of second, with 3 setule-like projections on outer distal surface; second segment with triangular, heavily sclerotized terminal process. Female with pair of oval adhesion pads present posterior to mouth cone (fig. 11*e*), extending posteriorly on V-shaped region of heavy sclerotization connected to maxilliped bases. Male with 2 slender, slightly ridged adhesion pads present posterior to mouth cone base, between maxilla bases and on heavily sclerotized area connected to maxilliped bases.

Female maxilla (fig. 11*j*) 2-segmented, first segment slightly more than one and one-half times the length of second, well developed, with distinct knob-shaped projection of distal inner surface. Second segment tipped by 2 saber-shaped processes and tuft of plumosities. Male maxilla (fig. 11*k*) 2-segmented, first segment slightly less than one and one-half times the length of second, more strongly developed; second segment with 1 plumose, knoblike projection and 2 lightly plumose, seta-like terminal processes, outer almost twice the length of inner.

Female maxilliped (fig. 12*a*) 2-segmented, with broad base situated just posterior and medial to maxilla base, along V-shaped region of heavy sclerotization. First segment with heavily sclerotized proximal projection serving as articulation and muscle attachment surface.

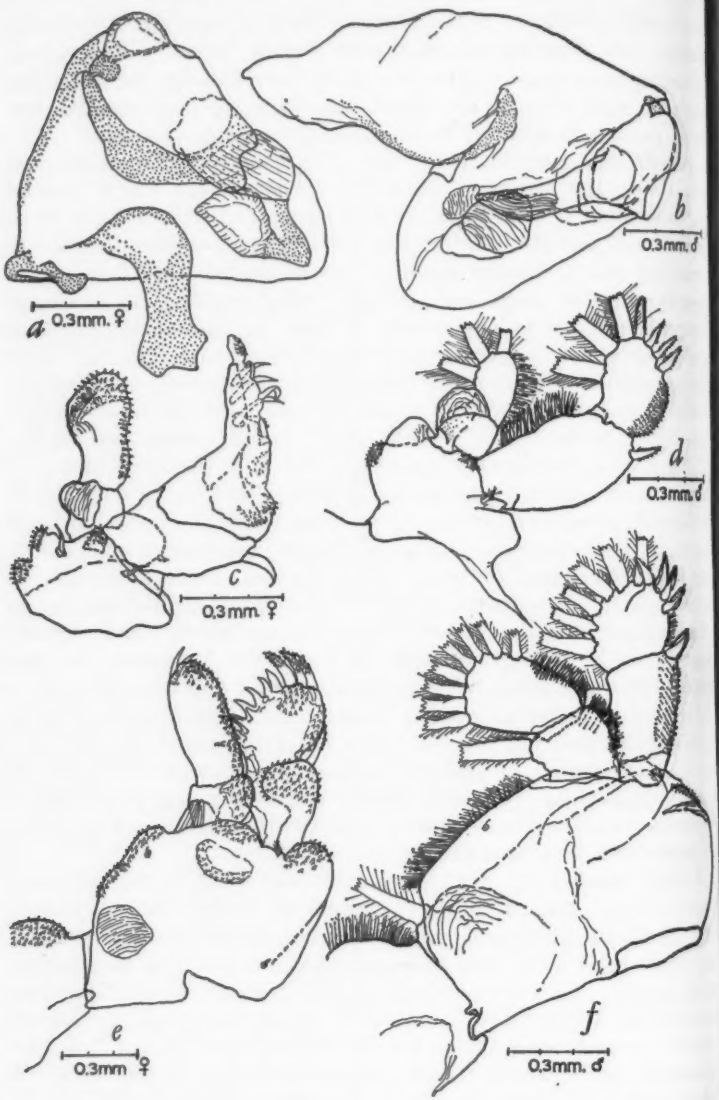

FIGURE 12.—*Pandarus cranchii* Leach, 1819. Right maxilliped, anterior view: *a*, female; *b*, male. Right thoracic legs, anterior view: *c*, female, first leg; *d*, male, first leg; *e*, female, second leg; *f*, male, second leg.

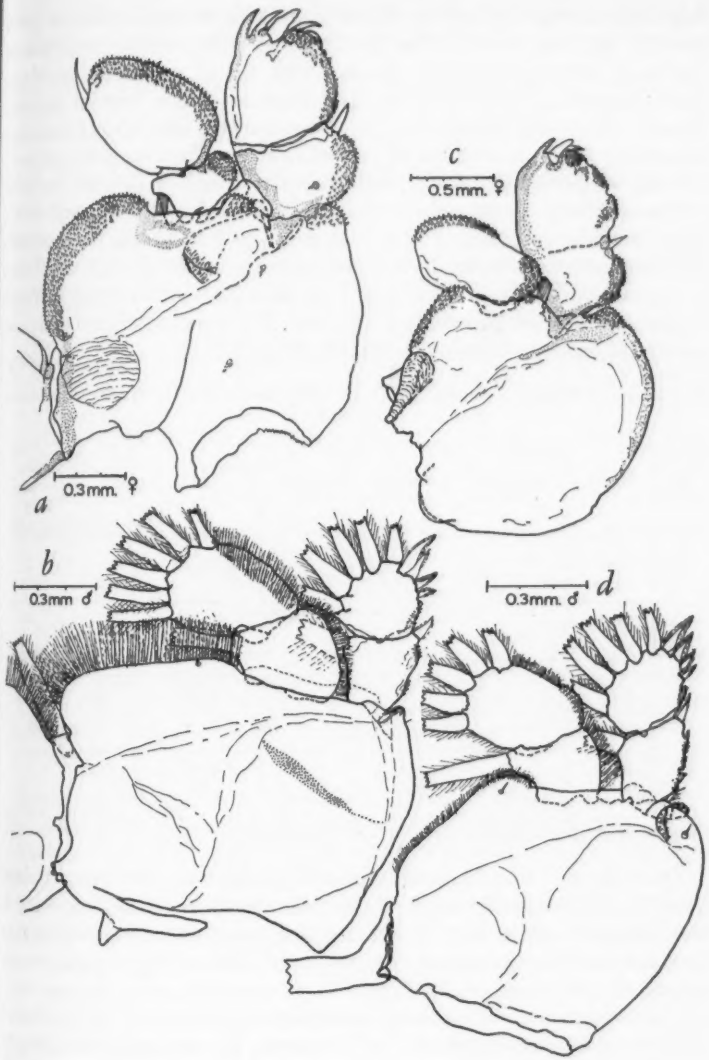

FIGURE 13.—*Pandarus cranchii* Leach, 1819, right thoracic legs, anterior view: *a*, female, third leg; *b*, male, third leg; *c*, female, fourth leg; *d*, male, fourth leg.

Segment tapered to narrow distal end, with several adhesion pads. Second segment short, with proximal swelling and broad, almost laminate terminal process, process with distal concavity overlying knob-shaped adhesion pad on first segment when second segment flexed. Male maxilliped (fig. 12*b*) 2-segmented, also with broad base extending along area of heavy sclerotization. First segment strongly developed, broadest distally, with rounded, padlike process on inner surface. Second segment short, heavily sclerotized, with well developed clawlike terminal process that overlaps 2 adhesion pads present on distal anterior surface of first segment when second segment flexed.

Female and male thoracic legs I–IV biramous, with some evidence of fusion exhibited, especially in female. For anlaysis of armature and nature of legs, see tables 4, 5, figures 12*c–f*, 13*a–d*.

TABLE 4.—*Armature of thoracic legs I–IV of the female of* Pandarus cranchii *Leach, 1819*

Leg	Surface	Interpodal Plate	Protopodite	Exopodite		Endopodite	
				1	2	1	2
I	outer		p	P	d, 6P, dB*		d
	inner		d, d, p, d			a	3P, d
II	outer	d	s, d, p	d, dH	d, 3dH	d	d
	inner		a, d, s, d, d		6Cl, H		4H, d
III	outer	d	d, p	d, s, H	d, 4H	d	d
	inner		a, d, s		2Cl		2H, d
IV	outer		r, d, s, d, p	d, H	d, d, d, 4H	d, d	
	inner		a, d, s		Cl		

*Process denticulated, appears fused with segment, not distinct as in *P. satyrus*.

DISCUSSION.—*Pandarus cranchii* and *P. satyrus* were synonymized by Shiino (1954c). Based on the female specimens of both species in the collection under description, there appears sufficient evidence to warrant the maintenance of both species. This evidence includes the length of the caudal rami (longer in *P. cranchii*), the presence of a single-lobed process on antennal segment 2 of *P. cranchii* and a bilobed process on the same segment in *P. satyrus*, the 1-segmented postoral process of *P. cranchii* and the 3-segmented postoral process of *P. satyrus*, the presence of a clump of plumosities on segment 2 of the maxilla of *P. cranchii* and their absence on the same segment of *P. satyrus*, the nature of the thoracic leg armature (compare tables 3

and 4). These two species will be discussed more thoroughly in a forthcoming review of the family Pandaridae by Roger Cressey.

TABLE 5.—*Armature of thoracic legs I-IV of the male of* Pandarus cranchii *Leach, 1819*

Leg	Surface	Interpodal Plate	Protopodite	Exopodite		Endopodite	
				1	2	1	2
I	outer inner		p d, p, d*	dmH c	d, 4dmH 3P	 a	c 3P
II	outer inner	c	d, p a, P, c, s	d, c, mH c, P	d, 3dmH, mH, P c, 5P	c P	c, 4P c, 4P
III	outer inner	c	d, p P, c, s	d, d, mH c, P	d, 4dmH, 2P c, 3P	c P	c, 3P c, 3P
IV	outer inner		d, s, p c, s	d, d, H c, P	d, 3dmH, mH, 2P 3P	c P	d, c, 2P c, 3P

*Denticulations between rami.

Pandarus smithii Rathbun, 1886

FIGURES 14*a–d*, 15*a–h*, 16*a–d*

Pandarus smithii Rathbun, 1886, p. 315, pl. 5, fig. 3, pl. 7, fig. 9.—Rathbun, M. J., 1905, p. 95.—Wilson, 1907b, p. 410, pls. 29–30.—Fowler, 1912, p. 479.—Wilson, 1932, p. 434, fig. 272.—Brian, 1944, p. 202, pl. 5, fig. 40.—Carvalho, 1945, p. 110, fig. 28.—Barnard, 1955, p. 259.—Shiino, 1959b, p. 353, fig. 8.

REPORTED HOSTS.—*Carcharhinus milberti, Carcharinus obscurus Carcharias taurus, Carcharodon carcharias, Sphyrna zygaena.*

DISTRIBUTION.—North Atlantic, Gulf of Mexico, Pacific (western, central and southern regions), South Africa.

MATERIAL.—Two ovigerous and 1 nonovigerous adult females (USNM 110807) collected by Susumo Kato from the external surface of several specimens of sharks captured by longline off Oahu, Hawaii. Two nonovigerous adult females (USNM 110808) collected by the Hawaii Fish and Game Department from the buccal cavity of *Carcharhinus melanopterus*? captured by longline in Yokohama Bay, Hawaii. Two nonovigerous adult females (USNM 110809) collected by the Hawaii Fish and Game Department from the external surface of *Carcharhinus melanopterus*? captured by longline in Kealekua Bay, Hawaii.

MEASUREMENTS.—Seven female specimens:

	mean (mm.)	range (mm.)
Greatest length	8.60	7.84–9.80
Greatest length of cephalothorax	4.37	4.06–4.55
Greatest width of cephalothorax	4.42	4.20–4.55
Greatest length of genital segment	2.69	2.24–3.08
Greatest width of genital segment	3.03	2.73–3.22
Greatest length of caudal rami	1.65	1.61–1.75
Greatest length of anal lamina	1.75	1.47–1.89
Length of egg strings (2 specimens)		7.70, 8.40

DIAGNOSTIC DESCRIPTION OF FEMALE.—Cephalothorax (fig. 14*a*) consisting of cephalic, maxilliped-bearing and first pedigerous segments, narrower anteriorly than posteriorly; lateral margins flatly convex, posterior concave, with 8 irregular denticulations medially. Frontal region narrow, with distinct median depression. Second through fourth pedigerous segments (figs. 14*b*, *c*) free, second and third each with single plate covering median dorsal surface, second with pair of ovoid plates originating from lateral dorsal surface, extending posteriorly and laterally; third pedigerous segment with pair of small, posteriorly rounded plates dorsally, extending posteriorly and laterally, slightly overlapped by plates of second pedigerous segment. Fourth pedigerous segment with single, large, apron-shaped plate dorsally, extending posteriorly over most of genital segment.

Genital segment (figs. 14*b*, *c*) wider than long, slightly narrower posteriorly than anteriorly; lateral margins flatly convex, posterior and anterior margins concave laterally, irregular medially, posterolateral projection each tipped by single denticulation. Large, rounded anal lamina attached to dorsal surface of posterior concavity, extending posteriorly to distal end of caudal rami. Abdomen (fig. 14*c*) 1-segmented, extending posteriorly from posteroventral surface of genital segment; narrower anteriorly, broadly rounded posteriorly, bearing pair of heavily sclerotized, distally pointed caudal rami directed posteriorly and laterally. Caudal rami attached to abdomen by broad base formed of cuticular extension of proximal half of ramus.

Color pattern of alcohol preserved material similar to that of *Pandarus satyrus*.

Antennule (figs. 14*d*, 15*a*) 2-segmented, first segment more than twice the length of second, curved posteriorly in distal region; with approximately 23 naked setae on anterior ventral surface. Second segment rounded distally, with approximately 7 fine setules on distal surface and 1 on medial posterior surface. Antenna (figs. 14*d*, 15*b*) 3-segmented, proximal segment with oval adhesion pad, smaller than postantennular adhesion pad, extending across ventral surface of most of cephalic depression bearing antenna. Second antennal segment longer than first, with heavily sclerotized, knob-shaped projection on

distal outer surface. Third segment short, with heavily sclerotized, strongly curved, clawlike terminal process and 2 small, spikelike accessory processes. Mandible (figs. 15*c–e*) 2-parted although proximal part with indistinct break in cuticle; distal end of second part

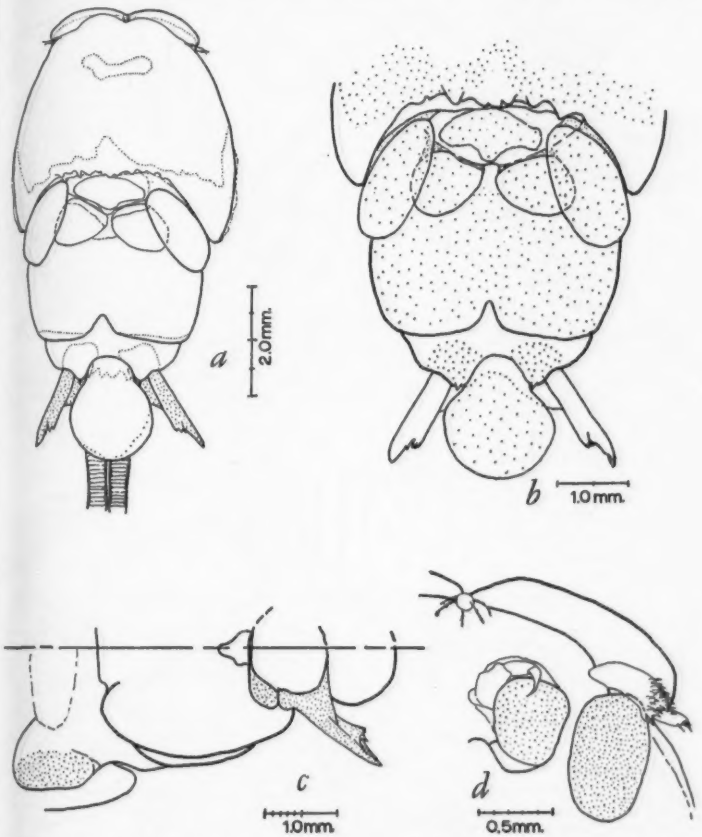

FIGURE 14.—*Pandarus smithii* Rathbun, 1886, female: *a*, dorsal view; *b*, postcephalothoracic region, dorsal view; *c*, third pedigerous segment, genital segment, abdomen, caudal ramus, and anal lamina, ventral view (fourth pedigerous segment not visible); *d*, postantennular and antennal adhesion pads, ventral view.

curved slightly, with 9 denticulations. Postantennular adhesion pad (fig. 14*d*) large, oval, extending posteriorly past antenna. Postoral process (figs. 15*c*, *f*) irregularly lobate, with spinelike terminal process, minute and knob-shaped accessory process on medial outer surface and indentation on distal inner surface. Postoral adhesion

pad (fig. 15*c*) situated just medial to maxilla base, on heavily sclerotized ridge extending to maxilliped base. Maxilla (fig. 15*g*) 2-segmented, first segment more strongly developed than second and

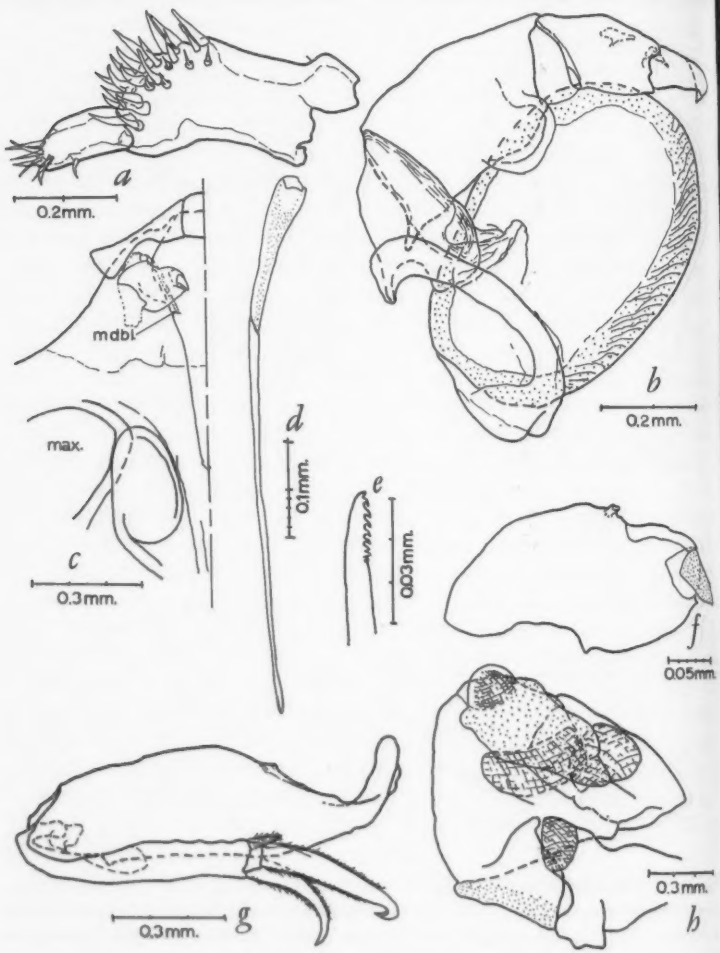

FIGURE 15.—*Pandarus smithii* Rathbun, 1886, female: *a*, right antennule, ventral view; *b*, right antenna, anterior view; *c*, oral and postoral region, ventral view, showing mouth cone, part of mandible (mdbl), postoral process, position of maxilla (max), and adhesion pad adjacent to maxilla; *d*, left mandible; *e*, denticulated portion of mandible; *f*, postoral process; *g*, maxilla; *h*, maxilliped.

more than one and one-half times its length, excluding terminal processes. Second segment with 2 saber-shaped terminal processes and small, plumose knob adjacent to terminal processes.

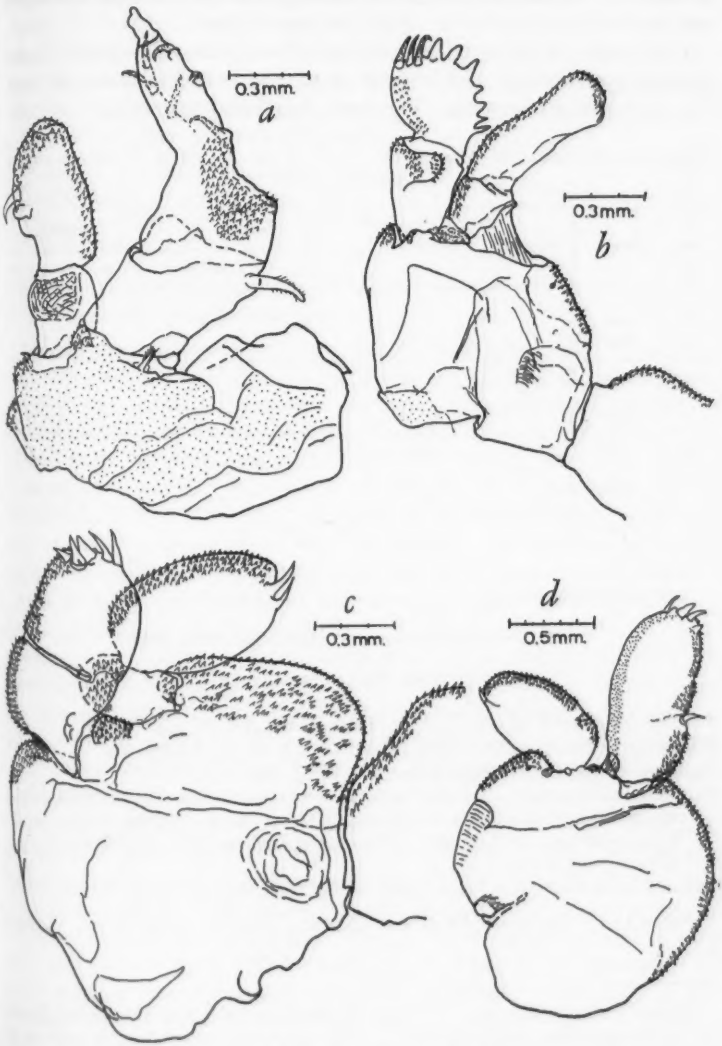

FIGURE 16.—*Pandarus smithii* Rathbun, 1886, female, right thoracic legs: *a*, first leg, anterior view; *b*, second leg, posterior view; *c*, third leg, posterior view; *d*, fourth leg, anterior view.

Maxilliped (fig. 15*h*) 2-segmented, first segment well developed, irregularly triangular, with several heavily sclerotized adhesion pads and processes. Second segment short, with proximal knoblike projection and bilobed, lappet-like terminal process that overlaps adhesion pad on first segment when second segment flexed.

Four pairs of thoracic legs biramous, evidence of segment fusion present, particularly with regard to exopodite of legs three and four. For nature of armature and legs, see table 6 and figure 16.

TABLE 6.—*Armature of thoracic legs I-IV of the female of* Pandarus smithii *Rathbun, 1889*

Leg	Surface	Interpodal Plate	Protopodite	Exopodite		Endopodite	
				1	2	1	2
I	outer		p	P	d, 6P′, B		d
	inner		d, d, p, d*			a	3H, d
II	outer	d	d, p		3rH	d	d
	inner		a, d, s, d*		7Cl		4H
III	outer	d	d, p	d	d, 3H	d	d
	inner		a, d, s, d*		2H		2H
IV	outer		d, s, p	d, H, d, d, 3H		d, d	
	inner		a, d, s, d*	2H		h	

* Denticulations between rami.

***Phyllothyreus cornutus* (Milne-Edwards, 1840)**

FIGURES 17*a–e*, 18*a–f*, 19*a–d*

Phyllophora cornuta Milne-Edwards, 1840, p. 472, pl. 38, figs. 13–14.
Nogagus grandis Steenstrup and Lütken, 1861, p. 46, pl. 10, fig. 19.
Phyllophorus cornutus.—Bassett-Smith, 1899, p. 465.
Phyllothyreus cornutus.—Norman, 1903, p. 368.—Norman and Scott, 1906, p. 212, pl. 24, figs. 9–17.—Scott and Scott, 1913,[3] p. 92, pl. 19, figs. 11–18, pl. 23, fig. 3.—Wilson, 1932, p. 440.—Monod and Dollfus, 1938, p. 196, figs. 1–15.—Brian, 1946, p. 142.
Laminifera doello-juradoi Brian, 1944, p. 205, pl. 4, figs. 30–37, pl. 5, figs. 38–39.

REPORTED HOSTS.—*Prionace glauca*, *Isurus oxyrinchus*, *Lamna nasus*.

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[3] These authors describe the genus *Phyllothreus* [sic] and the species *Phyllothreus* [sic] *cornutus* (Milne-Edwards). The apparent misspelling is present in every citation.

DISTRIBUTION.—Mediterranean, England, warmer parts of the Atlantic (Steenstrup and Lütken, 1861), Tongatabu (Friendly Islands).

MATERIAL.—One adult male (USNM 110810) collected by E. C. Jones and Kenneth Sherman from the fin of a specimen of *Prionace glauca* captured by longline at 40°15′N., 170°16′W. Although the specimen was collected out of the Hawaiian area, the presence of the host around the Hawaiian Islands and the known distribution of the parasite suggest its probable occurrence in the area.

MEASUREMENTS.—One adult male:

	(mm.)
Greatest length, excluding setae	15.54
Greatest length of cephalothorax	7.42
Greatest width of cephalothorax, excluding membranes	7.42
Greatest length of genital segment	3.85
Greatest width of genital segment	3.36
Greatest length of abdomen	1.68
Greatest length of caudal rami	2.73

DIAGNOSTIC DESCRIPTION OF MALE.—Cephalothorax (fig. 17*a*) approximately as wide as long, consisting of cephalic maxilliped-bearing and first pedigerous segments. Frontal region narrow, separated from remaining cephalothorax by distinct line of division. Membrane-rimmed lateral cephalothoracic margins smoothly convex, posterolateral regions extending well posterior of posterior median cephalothoracic region and forming, with lateral margins of free second pedigerous segment, distinct sinuses. Membrane on lateral cephalothoracic margins continuous around posterior extension of lateral regions, terminating at anterior end of sinus; additional membrane present, projecting dorsally and extending transversely across anterior end of sinus. Dorsal cephalothoracic grooves distinct, extending anteriorly from sinus apex, curving laterally sharply just anterior to ocular region, terminating at lateral margin just posterior to antennule. Eyes small, with small pigmented region around each lens, pigmented regions of both eyes contiguous on median longitudinal axis of body.

Second, third, and fourth pedigerous segments (fig. 17*b*) free, second and third indistinctly and incompletely fused. Second segment narrower anteriorly than posteriorly, width much greater than length, lateral margins concave anteriorly, convex posteriorly, lateroposterior regions extending laterally as winglike processes with membranous margins. Third pedigerous segment slightly narrower than second, broader anteriorly than posteriorly, without winglike projections but with pair of small, knoblike projections at junction with second pedigerous segment. Fourth pedigerous segment distinct

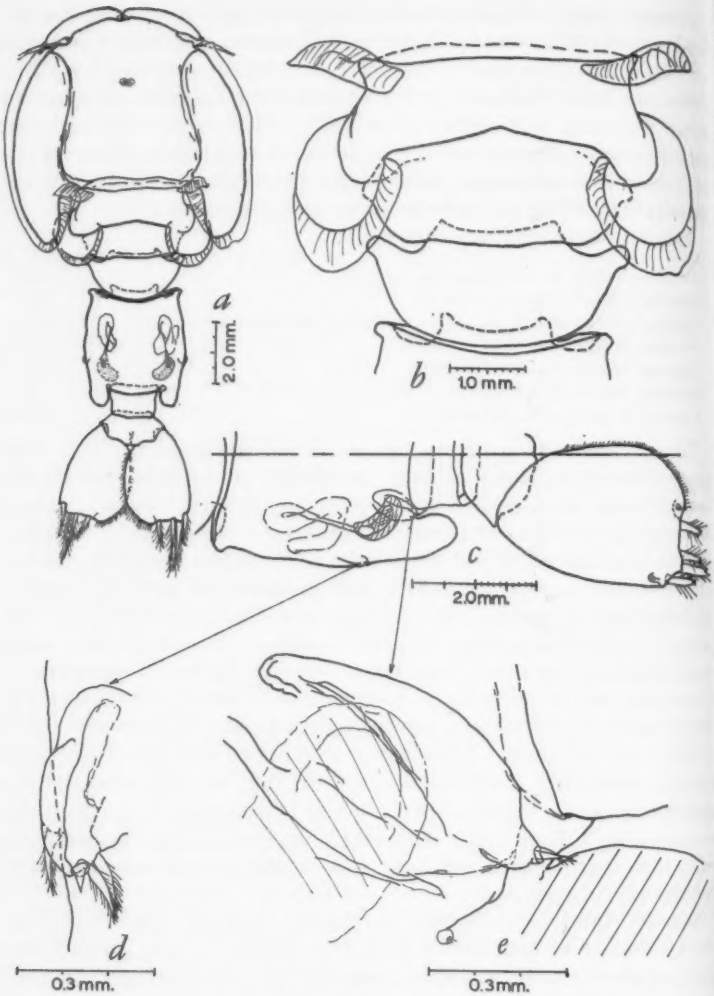

FIGURE 17.—*Phyllothyreus cornutus* (Milne-Edwards, 1840), male: *a*, dorsal view; *b*, free pedigerous segments, ventral view; *c*, genital segment, abdomen, and caudal ramus, ventral view; *d*, right fifth leg, ventral view; *e*, right sixth leg, ventral view.

from both third and genital segments, lyre-shaped although anterior end with large, heavily sclerotized, knob-shaped anterior lateral projections.

Genital segment (fig. 17*c*) barrel-shaped except for lappet-like lateral posterior projections, anterolateral corners of segment forming small, knoblike, heavily sclerotized projections. Fifth leg (fig. 17*d*) small, slightly irregular, projecting from ventral lateral surface of genital segment just posterior to middle of segment, bearing single, small, spiniform projection and 3 plumose setules. Sixth leg (fig. 17*e*) consisting of small, spiniform projection and single setule at posterior end of oval irregularity of ventral genital segment surface in region of genital opening.

Abdomen (fig. 17*c*) 2-segmented, first segment subrectangular, wider than long; second segment narrow anteriorly, flared to middle of segment then curved irregularly to anal concavity. Caudal rami (fig. 17*c*) greatly enlarged, slightly shorter than genital segment, excluding projections, laminate, with inner lateral margins plumose, bearing 4 large, plumose setae from distal surface and 2 small setules, one on each posterolateral surface.

Antennule (fig. 18*a*) 2-segmented, attached to irregularity of anteroventral cephalothoracic surface and posteroventral surface of frontal region. Both segments of general elongate nature, first approximately one and one-third times the length of second, flattened ventrally, rounded dorsally, bearing approximately 22 plumose and naked setules. Second segment rounded distally, with 6 small, spinelike projections and 4 naked setules from distal surface, 1 naked setule from distal dorsal surface. Antenna (fig. 18*b*) 3-segmented, situated medial and posterior to antennule base and lateral to oral region. First segment flattened, proximal end abutting against small, heavily sclerotized, padlike projection of cephalothorax. Third segment and terminal process fused, clawlike, with 2 setule-like accessory processes, 1 medially, second proximally. Mandible (fig. 18*c*) 2-parted, proximal end articulating in circular depression in platelike region of heavy sclerotization; appendage rodlike, distal end sharply rounded, distal inner surface denticulated. Postantennular adhesion pad (fig. 18*a*) similar to that of *Pandarus* but not as well developed, with irregular cross striations. Postoral process (fig. 18*d*) irregularly lobate, tipped by spiniform process. Postoral adhesion pads (fig. 18*e*) small, knob-shaped, situated slightly posterior to mouth cone, at beginning of heavily sclerotized region forming articulation surface for maxilla and maxilliped. Maxilla (fig. 18*e*) 2-segmented, first segment approximately one and one-third times the length of the second, with proximally projecting articulation surface (not visible in figure). Second segment narrower proximally than distally,

tipped by 2 saber-shaped processes, innermost approximately one and one-half times the length of the outer, outer with rows of short, stiff plumosities.

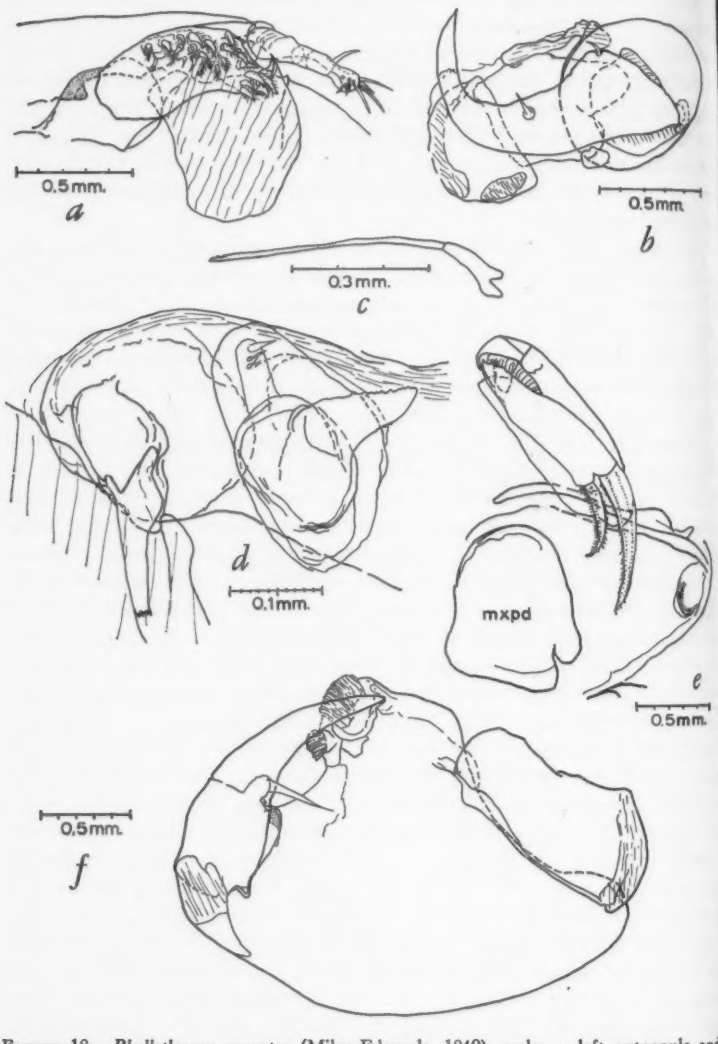

FIGURE 18.—*Phyllothyreus cornutus* (Milne-Edwards, 1840), male: *a*, left antennule and adhesion pad, ventral view; *b*, left antenna, ventral view; *c*, left mandible; *d*, left postoral process and mouth cone base, ventral view; *e*, right maxilla and maxilliped base (mxpd), ventral view; *f*, right maxilliped, lateral view.

Maxilliped (fig. 18*f*) 2-segmented, attached immediately posterior and medial to maxilla base. First segment strongly developed, broad proximally, narrow distally, with 2 small adhesion projections on anterior lateral surface against which second segment terminal process shuts when second segment flexed. Second segment short,

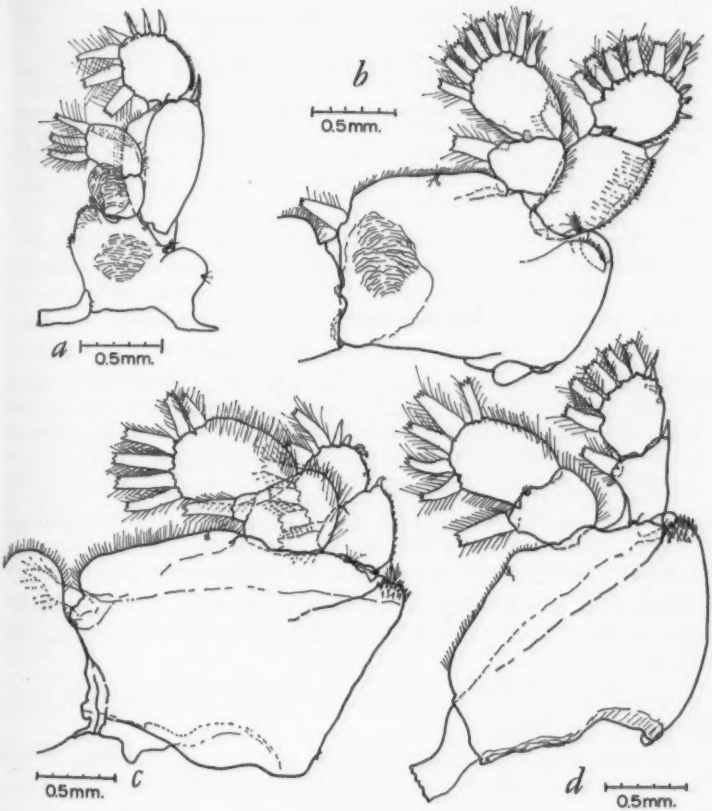

FIGURE 19.—*Phyllothyreus cornutus* (Milne-Edwards, 1840), male, right thoracic legs, anterior view: *a*, first leg; *b*, second leg; *c*, third leg; *d*, fourth leg.

terminal process longer than segment, together forming clawlike structure. Long, seta-like accessory process present at junction of second segment and terminal process.

Thoracic legs I–IV biramous, protopodite 1-segmented, rami 2-segmented. For nature of armature and legs see table 7 and figures 19*a–d*.

TABLE 7.—*Armature of thoracic legs I–IV of the male of* Phyllothyreus cornutus *(Milne-Edwards, 1840)*

Leg	Margin	Interpodal Plate	Protopodite	Exopodite		Endopodite	
				1	2	1	2
I	outer inner		1ss, p 2d, 2s, p	dmH c	d, 3dmH, H 3P	 s	c, P 2P
II	outer inner	c	d, p P, c, 1ss	d, H c, P	d, 3fmH, H c, 6P	c P	c, 4P c, 3P
III	outer inner	c	d, p P, c, s	d, h P	d, 3h, H 5P	c P	c, 2P c, 4P
IV	outer inner		d c, 1ss	c, H c, P	c, 2h, 2H c, 5P	c P	c, 2P c, 3P

Dinematura[4] *latifolia* Steenstrup and Lütken, 1861

FIGURES 20*a–f*, 21*a–h*, 22*a–g*, 23*a–b*

Dinematura latifolia Steenstrup and Lütken, 1861, p. 378, pl. 8, fig. 16.—Heller, 1865, p. 199.—Richiardi, 1880, p. 3.—Stossich, 1880, p. 257.—Valle, 1880, p. 60.—Carus, 1885, p. 360.—Brian, 1898, p. 14, pl. 2, fig. 10.—Bassett-Smith, 1899, p. 463.—Brian, 1902, p. 44; 1906, p. 52.—Wilson, 1907b, p. 383, pls. 24–25.—Fowler, 1912, p. 479.—Wilson, 1923, p. 6, pl. 1, figs. 6–10; 1932, p. 432, fig. 271; 1935c, p. 778.—Yamaguti, 1936, p. 9, pl. 5, figs. 50–52; pl. 6, figs. 53–61.—Brian, 1944, p. 201.—Delamare-Deboutteville and Nunes-Ruivo, 1953b, p. 204, figs. 2–3.—Shiino, 1954c, p. 308, figs. 9–10.—Barnard, 1955, p. 263, fig. 16.—Shiino, 1957, p. 365.—Heegaard, 1962, p. 177.

REPORTED HOSTS.—*Isurus oxyrinchus*, *Prionace glauca*, *Carcharodon rondeletti* (=*Carcharodon carcharias*?), *Lamna nasus*, *Carcharodon carcharias*.

DISTRIBUTION.—North Atlantic, Adriatic, Argentina, South Africa, North Pacific, Japan.

MATERIAL.—Five ovigerous and 1 nonovigerous adult females (USNM 110811) collected by the U.S. Fish and Wildlife Service from the external surface of a "Mackerel Shark" captured by longline at 45°58′ N., 162°33′ W. One nonovigerous adult female (USNM 110812) collected by Susumo Kato from the external surface of an unknown shark captured by longline off Oahu, Hawaii. Seven nonovigerous and 1 ovigerous adult females in addition to 1 adult male (USNM

[4] The references using the spelling *Dinemoura* are not designated in the synonymy. The improper latinization of the generic name (*Dinemoura*) by Latreille (1829) was corrected to *Dinematura* by Burmeister (1835).

110813) collected by the Hawaii Division of Fish and Game from the external surface of a specimen of *Carcharodon carcharias* captured by longline at Pokai Bay, Hawaii.

MEASUREMENTS.—Sixteen females, one male:

	female		*male*
	mean (mm.)	*range (mm.)*	*(mm.)*
Greatest length, excluding setae	12.47	11.20–14.28	8.80
Greatest length of cephalothorax	5.91	5.04– 6.65	4.60
Greatest width of cephalothorax, excluding flanges	6.75	5.81– 7.63	4.10
Greatest length of genital segment	5.73	4.90– 6.58	2.30
Greatest width of genital segment	3.96	3.01– 4.34	1.15
Greatest length of abdomen	1.66	1.40– 1.89	0.90
Approximate length of egg string (6 female specimens)	26.27	8.40–37.10	

DIAGNOSTIC DESCRIPTION.—Female cephalothorax (fig. 20*a*) suborbicular, consisting of cephalic, maxilliped-bearing and first pedigerous segments; frontal region narrow, anterior margin irregular, anterior lateral cephalothoracic margin with indistinct indentation. Membrane-rimmed lateral cephalothoracic margins regular, with small but distinct indentation medially that forms outer end of indistinct, irregular groove extending laterally from posteromedial cephalothoracic region. Lateral cephalothoracic regions extending posteriorly to anterior end of genital segment, well posterior to median cephalothoracic region. Posteromedian region with narrow, flangelike extension dorsally, overlapping anterior half of narrow second pedigerous segment. Dorsal cephalothoracic grooves distinct, major pair extending anteriorly from junction of inner margin of lateral cephalothoracic region and median cephalothoracic region to join with groove extending posteriorly from indentation of anterolateral cephalothoracic margin. Several minor grooves present although most indistinct. Eyes distinct though small consisting of 2 pigmented regions, contiguous on median longitudinal axis of body, and 2 minute, circular lenses. Cephalothorax of male (fig. 20*b*) similar to that of female, major differences consisting of regular instead of irregular anterior margin of frontal region, 2 instead of 1 small indentation of lateral cephalothoracic margin and with major dorsal cephalothoracic grooves appearing to terminate before joining groove extending posteriorly from indentation of anterolateral cephalothoracic margin.

Female second through fourth pedigerous segments (fig. 20*a*) free, second with 2-parted lateral extensions, anterior part heavily sclerotized, rodlike except for adhesion pad formed by swollen distal end; posterior part of extension heavily sclerotized anteriorly, with membranous margin posteriorly, both parts forming extension projecting under lateral cephalothoracic region and under anterior end of fourth

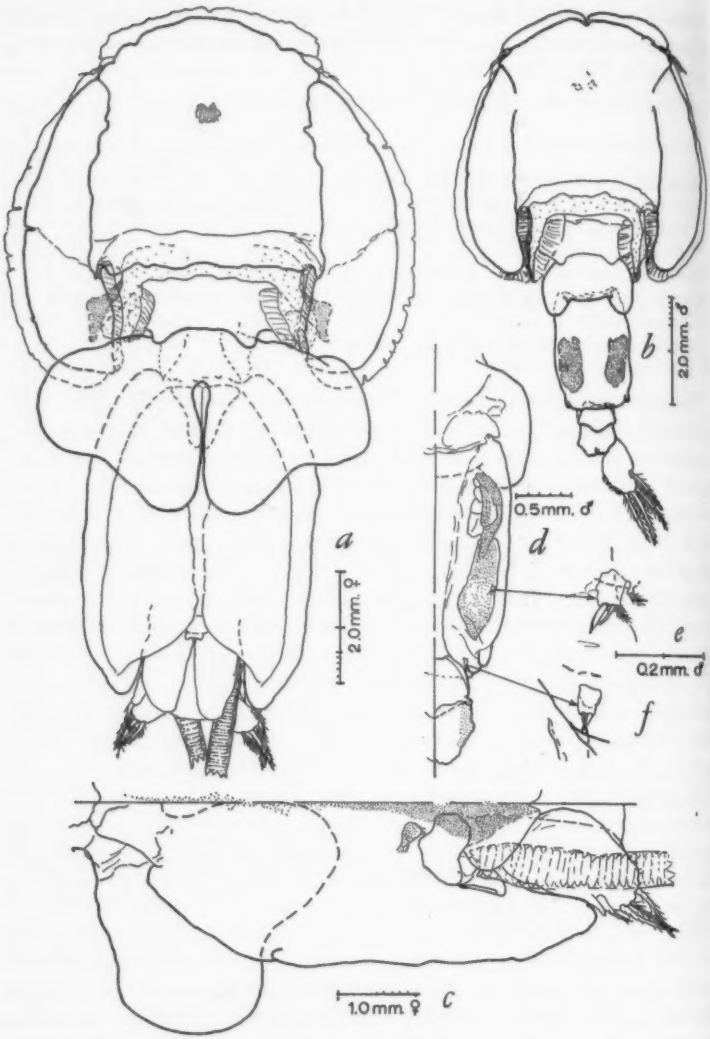

FIGURE 20.—*Dinematura latifolia* Steenstrup and Lütken, 1861: *a*, female, dorsal view; *b*, male, dorsal view; *c*, female, genital segment, abdomen, caudal ramus, and egg string, ventral view; *d*, male, genital segment, fifth and sixth legs, and abdomen, ventral view; *e*, male, fifth leg; *f*, male, sixth leg.

pedigerous segment ala. Third pedigerous segment width approximately twice the length, with knoblike swelling on lateral surface forming attachment and articulation surface for third thoracic leg, with pair of small, knoblike protrusions posteriorly, overlapping short anterior end of fourth pedigerous segment Fourth pedigerous segment distinct from genital segment dorsally although fused ventrally; segment small, slightly longer than wide, lateral surfaces distinct ventrally although tapered into large ala. Ala extending laterally, across dorsal surface of posterior end of lateral cephalothoracic region, extending posteriorly and covering anterior third of genital segment. Median posterior region of ala bilobed, with deep sinus separating lobes. Second through fourth pedigerous segments of male (fig. 20*b*) free, lateral projection of second not as well developed as in female. Third pedigerous segment as in female; ala of fourth pedigerous segment much smaller in male than in female, bilobed posteriorly although without deep sinus, overlapping anterior end of genital segment.

Female genital segment (fig. 20*c*) large, anterolateral corners rounded, median anterior surface concave; lateral margins flatly convex, posterolateral surfaces lobate, projecting posteriorly almost to end of caudal rami. Dorsal surface with platelike processes extending over most of segment and overlapping part of abdomen. Medial posterior surface forming place of attachment of large, orbicular projection (sixth segment of Wilson, 1907b) and pair of large, lobate laminae. Abdomen 1-segmented, projecting from ventral genital segment surface immediately posterior to attachment of orbicular projection and laminae (not attached to orbicular projection but to genital segment). Proximal end of abdomen broad, tapered sharply posteriorly. Caudal rami arising from sharp taper of abdomen. Rami strongly flattened, outer lateral portion folded, bearing 4 lightly plumose setae from distal region and minute setule medial to innermost seta.

Male genital segment (fig. 20*d*) slender, barrel-shaped, lateral regions appearing slightly swollen, posterolateral regions each with slender, knoblike area of heavy sclerotization distinct from rest of segment. Fifth leg (fig. 20*e*) consisting of knob-shaped protrusion bearing 1 plumose and 2 naked setules, single, plumose setule present just lateral to protrusion. Sixth leg (fig. 20*f*) a minute nodule bearing 2 naked setules. Abdomen 2-segmented, arising from posteroventral genital segment surface. First segment narrower anteriorly than posteriorly, length approximately three-fourths the width, posterior end with flattened, V-shaped outline. Second segment slightly longer than first, outline irregular, lateral regions curved ventrally and more heavily sclerotized than rest of segment, lateral posterior margins angled, surfaces forming attachment for caudal rami. Caudal rami

damaged although appearing similar to those of female except for greater plumosity of inner margin.

Female antennule (fig. 21*a*) 2-segmented, attached to lateral anterior ventral cephalothoracic surface at junction of lateral cephalothoracic margin and frontal region. First segment approximately two and one-half times the length of second, broader proximally than distally, with approximately 18 naked or finely plumose setules along edge of ridge extending along anterior and distal portions of ventral surface and terminating in small, subtriangular projection of distal posterior surface. Second segment club-shaped, with 2 naked terminal setules. Antennule of male (fig. 21*b*) with first segment slightly more than twice the length of second, bearing approximately 14 setules, distal 7 densely plumose; second segment with 1 short and 4 elongate, naked setules. Female antenna (fig. 21*c*) 3-segmented, first and second segments short, strongly developed, first with small adhesion pad; third segment and fused terminal process clawlike, terminal process strongly curved, segment with 2 setule-like accessory processes. Antenna of male (fig. 21*g*) 3-segmented, first segment without adhesion pad, second segment slightly shorter than first, with distinct adhesion surface on anterior distal surface, third segment and terminal process complex, segment short, distinct from terminal process, with small adhesion pad, terminal process short, clawlike.

Female and male mandible (figs. 21*d*, *e*) appearing 2-parted, rodlike, first part short, second part elongate, distal region of second part slightly flattened, rounded distally, inner margin with 12 denticulations. Female and male postantennular adhesion pad (fig. 21*a*) 2-parted, consisting of small, cup-shaped structure situated just posterior and lateral to antennule base, and just anterior to large, ovoid adhesion pad extending posteriorly and slightly medial. Postoral process of female (figs. 21*c*, *f*) appearing 4-segmented, proximal segment attached to rib-shaped region of heavy sclerotization connected to Y-shaped region surrounding mouth and extending anteriorly, rib-shaped region also forming attachment and articulation surface for mandible. Proximal segment of postoral process strongly developed, with at least 1 plumosity-bearing nodule (Shiino, 1954c, and others report 2 nodules); second and third segments elongate, subrectangular, fourth segment lamellate and folded and may be terminal process of third segment. Postoral process of male (fig. 21*g*) 3-segmented although third segment with irregularity attached to distal end that may be remains of fourth segment or terminal process. Female and male with pair of oval adhesion pads just posterior to mouth cone base (figs. 21*g*, *h*), situated on extensive region of heavy sclerotization forming articulation and muscle at-

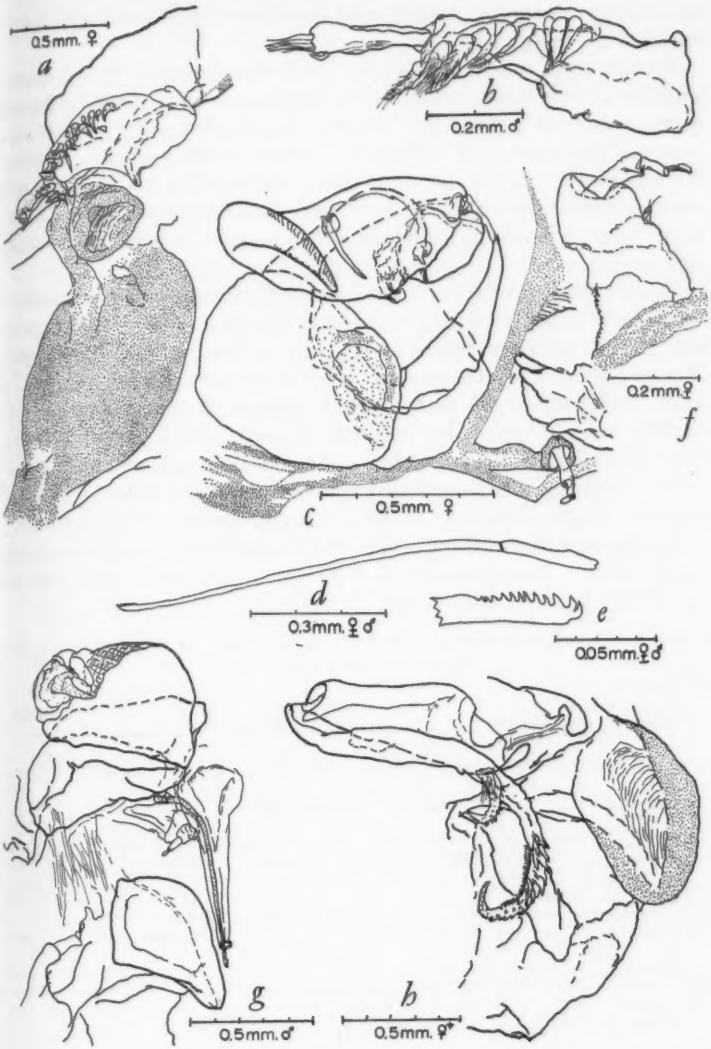

FIGURE 21.—*Dinematura latifolia* Steenstrup and Lütken, 1861: *a*, female, right antennule and postantennular process, ventral view; *b*, male, right antennule, ventral view; *c*, female, right antenna, mouth cone base, and postoral process, ventral view; *d*, right mandible; *e*, distal end of mandible; *f*, female, right postoral process, anterior view; *g*, male, right antenna, mouth cone, mandible (only one shown), postoral process, postoral adhesion pad, and maxilla base (max), ventral view; *h*, female, right maxilla and postoral adhesion pad (male maxilla similar).

tachment surfaces for maxilla and maxilliped, pads of male slightly longer than those of female.

Female and male maxilla (fig. 21*b*) 2-segmented, first segment slightly longer and more strongly developed than second. Second segment narrow proximally, broader distally, bearing 2 saber-shaped terminal processes with tuft of plumosities between them. Terminal processes covered, for the most part, by scalelike projections, each bearing minute, spiniform projections. Inner terminal process longer than outer, with fuzzy proximal outer margin in addition to scalelike projections.

Female maxilliped (fig. 22*a*) 2-segmented, situated just posterior and lateral to posterior end of postoral adhesion process, first segment with narrow proximal region and greatly enlarged, ovoid distal region. Second segment much smaller than first, articulating on pair of small indentations of posterodistal surface of first segment, with slightly curved, spinelike terminal process. Male maxilliped (fig. 22*b*) similar, in outline, to that of female although with 2 adhesion pads on enlarged portion of first segment, terminal process of second segment longer than that of female, more distinct from segment.

Female and male thoracic legs I–IV biramous, protopodite 1-segment, rami 1–3 segmented. For nature of armature and legs, see tables 8–9, figures 22*c–g*, 23*a–b*.

TABLE 8.—*Armature of thoracic legs I–IV of the female of* Dinematura latifolia *Steenstrup and Lütken, 1861*

Leg	Surface	Interpodal Plate	Protopodite	Exopodite			Endopodite		
				1	2	3	1	2	3
I	outer		p	fmH, d	fm, 2fmH, dmH, H			c, P	
	inner		2a, p	c	c, 3P		a	2P	
II	outer	c	2a, p	fm, d, fmH	fm, fmH	fm, 2fmh, fh	c	c	c, 2P
	inner		3a, P, c	c, P	c, P	c, 5P		c, 2P	c, 2P
III	outer	c	a, c, a	m, d, mH	m, mH	m, 3fmH	c	c	c, P
	inner		P, c, a	c, P	c, P	c, 5P	P,* c	2P	c, 2P
IV	outer			d, rh, h, d, h, d, h, d			d		
	inner			rh, d, rh, 2h			2rh, d		

* Wilson (1907b) and Shiino (1954c) do not indicate this armature element.

REMARKS.—Yamaguti (1936) and Shiino (1954c) both point out that Japanese specimens differ from the description given by Wilson (1907b) in the shape of the third pedigerous segment, the arrangement of the adhesion pads, and the number of spines on the thoracic legs. I am indebted to Dr. S. M. Shiino for the loan of a female specimen

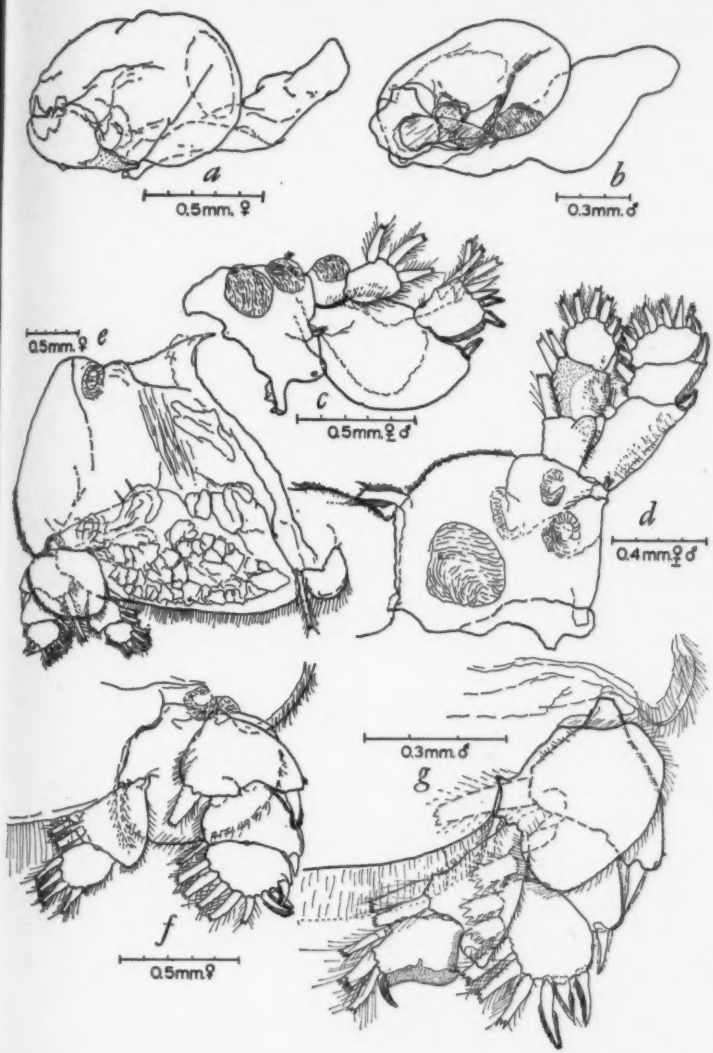

FIGURE 22.—*Dinematura latifolia* Steenstrup and Lütken, 1861. Maxilliped, ventral view: *a*, female; *b*, male. Right thoracic legs, anterior view: *c*, first leg; *d*, second leg; *e*, female, third leg. Rami, right third thoracic legs, posterior view: *f*, female; *g*, male.

TABLE 9.—*Armature of thoracic legs I–IV of the male of* Dinematura latifolia *Steenstrup and Lütken, 1861*

Leg	Surface	Interpodal Plate	Protopodite	Exopodite			Endopodite		
				1	2	3	1	2	3
I	outer		p	mh, d	fm, 3fmH, H		c	c, P	
	inner		2a, p	c	3P		a	2P	
II	outer	c	2a, p	c, fmH	fm, mH	fm, 3fmH	c	c	c, 3P
	inner		3a, P, 3s, c	c, P	c, P	c, 5P	P	c, 2P	c, 3P
III	outer	c	a, c	m, mH	m, mH	m, 3mH	c	c	2s
	inner		P, 3s, m, a	c, P	c, P	c, 5P	P, c	c, 2P	3P*
IV	outer		p	fmH	fm, 4fmH		P′	c, rh	
	inner		c, 1ss	c, pH	c, 3P			c, P, 2PH, p	

*Wilson (1907b) figures only 2 plumose setae.

of *D. latifolia* so that a comparison could be made of Japanese, Hawaiian, Pacific Coast and Atlantic Coast specimens. The shape of the third pedigerous segment is the same in all specimens and corresponds to the description given above. The postantennular adhesion pads are similar in all specimens, the smaller of the two being circular, not elliptical as stated by Wilson (1907b). The adhesion

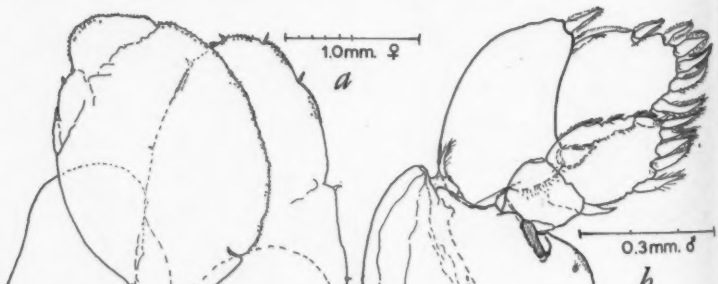

FIGURE 23.—*Dinematura latifolia* Steenstrup and Lütken, 1861, fourth thoracic leg, anterior view: *a*, female, right leg; *b*, male, left leg.

pads associated with the antennae are not as large in the Atlantic Coast specimens as they are on the Pacific specimens. The postoral adhesion pads, in all specimens, are of a general ovoid shape. The only difference in the thoracic leg armature of the specimens is that the fourth leg exopodite has 5 small spines in the Japanese specimens and 8 in the Atlantic, Pacific Coast, and Hawaiian specimens. This difference does not appear significant inasmuch as most of the margin has numerous denticulations in all specimens and the difference between a large denticle and a small spine or spinule is not very great.

Demoleus heptapus (Otto, 1821)

FIGURES 24*a–d*, 25*a–g*, 26*a–d*

Caligus heptapus Otto, 1821, p. 15.
Caligus paradoxus Otto, 1828, p. 352, pl. 22, figs. 5–6.
Binoculus sexsetaceus Nordmann, 1832, p. 32.
Dinematura sexsetacea.—Burmeister, 1835, p. 331.
Nogagus [*paradoxus*] Milne-Edwards, 1840, p. 460 (statement of affinity of *C. paradoxus* Otto with the genus *Nogagus*, no new combination).
Nogagus productus Gerstaecker, 1853 (in part), p. 64.—Wilson, 1907, p. 441.
Nogagus paradoxus.—Steenstrup and Lütken, 1861, p. 369.
Demoleus paradoxus.—Heller, 1865, p. 199, pl. 19, fig.3 .—Carus, 1885, p. 361.—Pearson, 1905, p. 26.—Brian, 1906, p. 50.—Wilson, 1907b, p. 349.—Scott and Scott, 1913, p. 79, pl. 12, figs. 4–5.
Demoleus heptapus.—Dollfus, 1943, p. 1, figs. 1–2.

REPORTED HOST.—*Hexanchus griseus*.

DISTRIBUTION.—Cosmopolitan.

MATERIAL.—One ovigerous female (USNM 110814) collected by the Hawaii Fish and Game Department from the external surface of a specimen of *Hexanchus griseus*? captured by longline in approximately 100 fathoms of water off Ala Moana, Oahu, Hawaii.

MEASUREMENTS.—One ovigerous female:

	(mm.)
Greatest length, excluding setae	13.86
Greatest length of cephalothorax	5.04
Greatest width of cephalothorax	4.90
Greatest length of genital segment	7.14
Greatest width of genital segment	3.71
Greatest length of abdomen	0.84
Greatest width of abdomen	1.33
Greatest length of caudal rami, excluding setae	2.87
Length of egg string	45.78

DIAGNOSTIC DESCRIPTION OF FEMALE.—Cephalothorax (fig. 24*a*) consisting of cephalic, maxilliped-bearing and first pedigerous segments; frontal region narrow, extending ventrally more than horizontally. Posterolateral cephalothoracic regions extending posteriorly well past median cephalothoracic region, to posterior end of

free third pedigerous segment. Lateral cephalothoracic regions extending ventrally, giving arched appearance to cephalothorax. Dorsal cephalothoracic grooves distinct, extending posteriorly from indentation marking junction of lateral cephalothoracic margin and frontal region to posterior end of median cephalothoracic region.

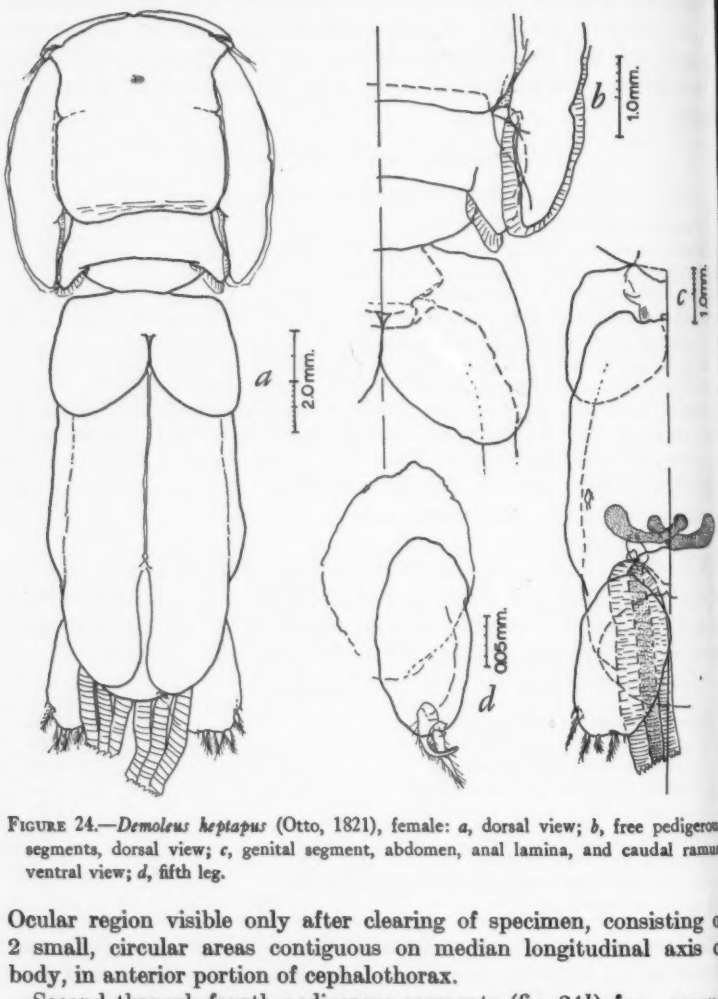

FIGURE 24.—*Demoleus heptapus* (Otto, 1821), female: *a*, dorsal view; *b*, free pedigerous segments, dorsal view; *c*, genital segment, abdomen, anal lamina, and caudal ramus, ventral view; *d*, fifth leg.

Ocular region visible only after clearing of specimen, consisting of 2 small, circular areas contiguous on median longitudinal axis of body, in anterior portion of cephalothorax.

Second through fourth pedigerous segments (fig. 24*b*) free, second more than twice as wide as long due to winglike lateral extensions bearing membranous border posteriorly. Third pedigerous segment

partially covered by second, slightly more than twice as wide as long, rounded posteriorly, without winglike extensions. Fourth pedigerous segment with large, posteriorly bilobed ala covering anterior end of genital segment, sinus between lobes deep, similar to that of *Dinematura latifolia*.

Genital segment (fig. 24*c*) distinct from fourth pedigerous segment, with 2 lobate posterior projections formed as extensions of pair of longitudinal swellings extending most of dorsal length of segment. Median posterior surface forming place of attachment of orbicular plate (sixth segment of Wilson, 1907b) extending posteriorly ventral to lobate posterior projections of segment. Fifth leg (fig. 24*d*) a minute, lobate projection from lateral ventral surface anterior to seminal receptacles, bearing 2 plumose setules. Abdomen (fig. 24*c*) 1-segmented, attached to slight swelling on ventral surface of genital segment, just posterior to seminal receptacles (each receptacle bearing large club-shaped spermatophore). Caudal rami (fig. 24*c*) large, laminate, with 4 plumose setae from posterior margin in addition to 2 setules, 1 on either side of group of setae.

Antennule (fig. 25*a*) 2-segmented, attached to lateral ventral cephalothoracic surface just posterior to division between cephalothorac and frontal region. First segment approximately one and two-thirds the length of second, slightly broader proximally than distally, appearing twisted so that anterior surface forms ventral surface distally, surface bearing approximately 22 setules and plumose setae. Second segment elongate, distal end with approximately 8 naked setules. Antenna (fig. 25*b*) indistinctly 3-segmented, poorly developed, attached medial and posterior to antennule base. First and second segments forming club-shaped structure, segments partially fused, division incomplete, visible at base of swollen distal end of club-shaped formation. Swollen end with irregular, narrow, platelike regions of heavy sclerotization that form adhesion surface. Third segment and terminal process claw-shaped. Mandible (figs. 25*c*, *d*) long, rodlike, articulating in plate-shaped region of heavy sclerotization closely associated with plate forming base of postoral process. Distal region of mandible not curved although slightly flattened, inner margin with 12 denticulations. Postantennular adhesion pad (fig. 25*a*) irregularly ovoid, with indistinct ridges. Postoral process (figs. 25*c*, *e*) elongate, lateral margins irregular, with small, 2-parted, conical subterminal process. Postoral adhesion (fig. 25*e*) pads elongate, situated at anterior medial end of region of heavy sclerotization associated with maxilla and maxilliped bases. Maxilla (fig. 25*e*) 2-segmented, first segment slightly longer than second and larger, second segment narrow proximally, flaring distally, distal end bearing 2 saber-shaped terminal processes and tuft of plumosities between processes. Inner

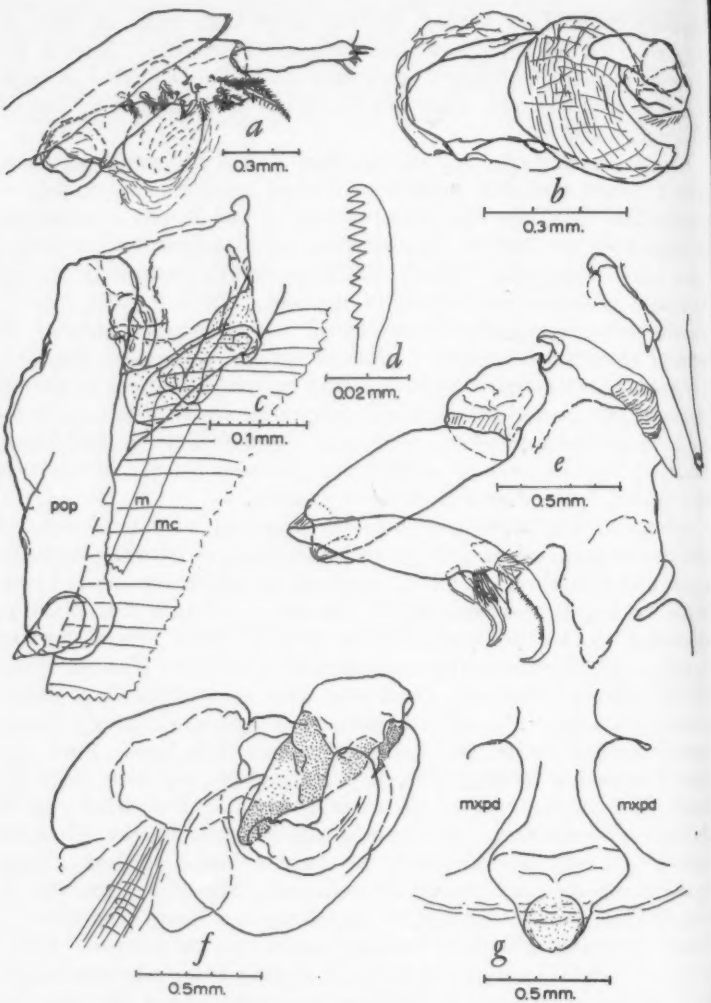

FIGURE 25.—*Demoleus heptapus* (Otto, 1821), female: *a*, left antennule and postantennular adhesion pad, ventral view; *b*, right antenna, ventral view; *c*, right postoral process (pop), part of mouth cone (mc), and mandible (m), ventral view; *d*, distal region of right mandible; *e*, mouth cone, right postoral process, postoral adhesion pad, and maxilla, ventral view; *f*, right maxilliped, ventral view; *g*, process between maxilliped bases (mxpd), ventral view.

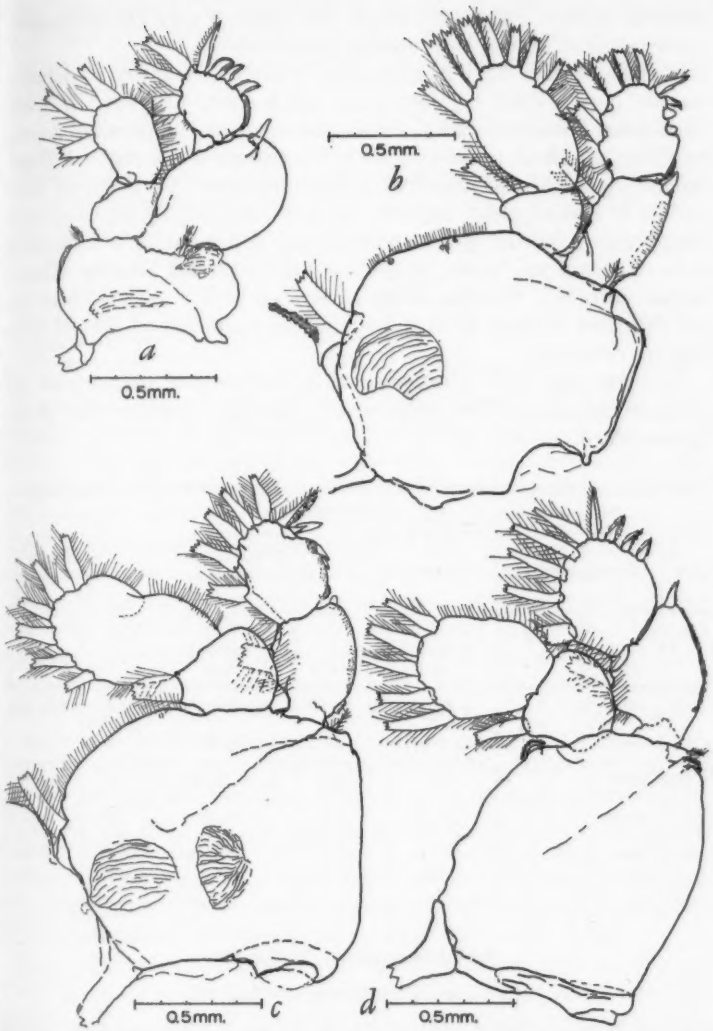

FIGURE 26.—*Demoleus heptapus* (Otto, 1821), female, right thoracic legs, anterior view: *a*, first leg; *b*, second leg; *c*, third leg; *d*, fourth leg.

terminal process longer than outer, with rows of very fine plumosities, outer terminal process with membranous borders.

Maxilliped (fig. 25*f*) 2-segmented, complex, situated posterior to maxilla base. First segment irregular, lumpy, with heavily sclerotized distal knob projecting past second segment and terminal process, receiving terminal process of second segment when segment flexed. Second segment and terminal process attached to posterior distal surface of first segment, segment distinct from distally rounded terminal process. Subtriangular process (fig. 25*g*) present between posterior ends of maxilliped bases, projecting ventrally and bearing adhesion surface distally. Process closely associated with maxilliped bases but not attached directly to them, similar to condition of sternal furca-bearing caligoids.

Thoracic legs I–IV biramous, with 1-segmented protopodite and 2-segmented rami. For nature of armature and legs see table 10 and figures 26*a–d*.

TABLE 10.—*Armature of thoracic legs I–IV of the female of* Demoleus heptapus *(Otto, 1821)*

Leg	Surface	Interpodal Plate	Protopodite	Exopodite		Endopodite	
				1	2	1	2
I	outer		s, fm, a, p	H	fm, 3H, Q		c, P
	inner		fm, p	c	c, 3P		2P
II	outer	fm	fm, p	fm, H	fm, 2h, mH, Q	c	c, rh, c, 3P
	inner		a, P, c, 2s, 1sss	c, P	c, 5P	P	c, 5P
III	outer	c	p	fm, h	fm, 2h, H, mH, Q	c	c, c, 2P
	inner		2a, p, c	c, P	c, 5P	P	c, 4P
IV	outer		fm, p	fm, H	3mH, Q	c	c, 2P
	inner		fm	c, P	c, 5P	P	c, 3P

Nesippus crypturus Heller, 1865

FIGURES 27*a–e*, 28*a–g*, 29*a–f*, 30*a–d*

Nesippus crypturus Heller, 1865, p. 196, pl. 18, fig. 4.—Bassett-Smith, 1899, p. 459.—Wilson, 1907b, p. 425 (in key); 1935b, p. 3, pl. 1, figs. 11, 13, 14, pl. 3, figs. 28–32.

REPORTED HOST.—*Sphyrna zygaena*.

DISTRIBUTION.—Java, Puerto Rico.

MATERIAL.—Eleven ovigerous, 13 nonovigerous adult females and 4 adult males (USNM 110815) collected by the Hawaii Fish and

Game Department from the nasal cavity of a specimen of *Galeocerdo cuvier* taken by longline at Maalaea Bay, Maui, Hawaii.

MEASUREMENTS.—Twenty-four female specimens and four male specimens:

	female		*male*	
	mean (mm.)	*range (mm.)*	*mean (mm.)*	*range (mm.)*
Greatest length, excluding setae	6.53	5.46– 7.42	5.93	5.81–6.16
Greatest length of cephalothorax	3.48	2.94– 3.85	3.01	2.94–3.08
Greatest width of cephalothorax	3.61	3.15– 3.99	3.03	2.94–3.15
Greatest length of genital segment	3.27	2.80– 3.85	1.40	1.33–1.47
Greatest width of genital segment	2.79	2.38– 3.15	1.45	1.40–1.54
Greatest length of abdomen	0.75	0.63– 0.91	0.33	0.28–0.35
Length of egg strings (11 specimens)	17.79	10.71–24.50	–	–

DIAGNOSTIC DESCRIPTION.—Female cephalothorax (fig. 27*a*) consisting of cephalic, maxilliped-bearing and first pedigerous segments, frontal region narrow, projecting ventrally. Lateral cephalothoracic margins strongly convex, posterolateral regions projecting posteriorly and medially well past flatly convex posterior margin of median cephalothoracic region to posterior end of fourth pedigerous segment. Dorsal cephalothoracic grooves distinct, extending anteriorly from junction of lateral and median cephalothoracic regions, terminating in anterior region of cephalothorax, just posterior to grooves extending posteromedially from indentation at junction of lateral cephalothoracic margin and frontal region. Eyes distinct as 2 small, pigmented regions contiguous on median longitudinal axis of body, between anterior terminations of major dorsal cephalothoracic grooves. Male cephalothorax (fig. 27*b*) consisting of cephalic, maxilliped-bearing and first pedigerous segments, frontal region narrow (as stated by Wilson, 1907b, but not as figured), not directed ventrally as in female. Lateral margins convex, posterolateral regions extending well past posterior median cephalothoracic region to posterior region of third pedigerous segment, with membrane along inner margin of extensions. Dorsal cephalothoracic grooves and ocular region as in female.

Second through fouth pedigerous segments of female (fig. 27*a*) free, second broad, with winglike lateral extensions bearing large, oval pad distally. Third pedigerous segment narrow, broader anteriorly than posteriorly. Fourth pedigerous segment slender, with pair of small alae laterally. Second through fourth pedigerous segments of male (fig. 27*b*) free, division between second and third evidenced only by indistinct line, second segment with small, lateral, membrane-margined extensions similar to posterior extensions of lateral cephalothoracic regions and, with anterolateral margin of third pedigerous segment, forming sinus. Fourth pedigerous segment broader than long, dis-

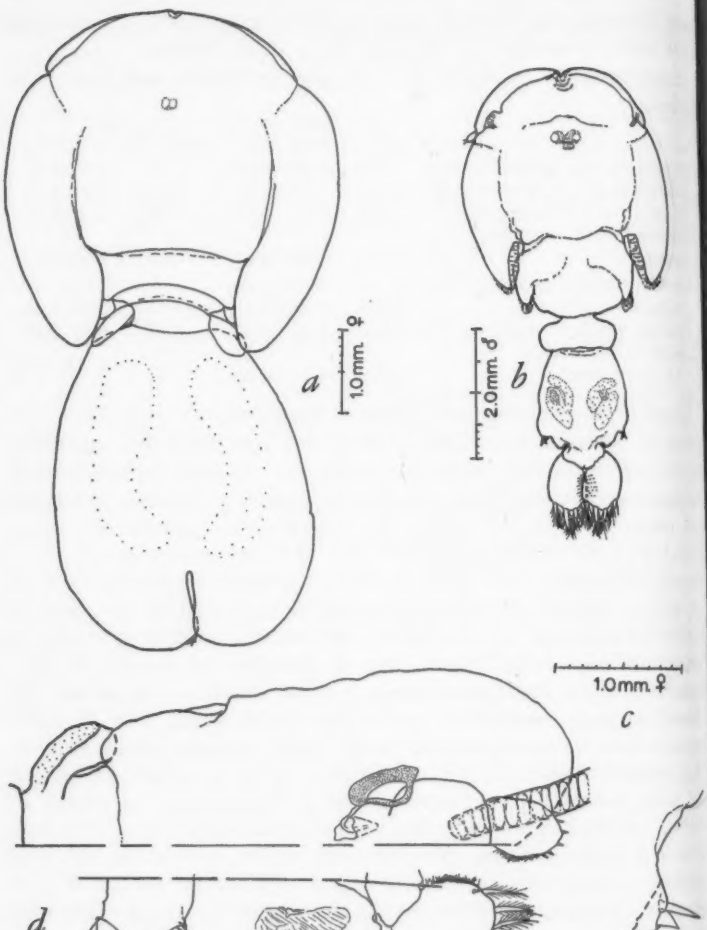

FIGURE 27.—*Nesippus crypturus* Heller, 1865: *a*, female, dorsal view; *b*, male, dorsal view; *c*, female, fourth pedigerous segment, genital segment, abdomen, and caudal ramus, ventral view; *d*, male, fourth pedigerous segment, genital segment, abdomen, and caudal ramus, ventral view; *e*, male, fifth leg, ventral view.

tinctly separated from third pedigerous segment and genital segment.

Female genital segment (fig. 27*c*) large, appearing swollen. Posterior end of segment wider than anterior, lateral margins flatly convex, posterior region bilobed, sinus between lobes narrow and deep. Male genital segment (fig. 27*d*) narrower anteriorly than posteriorly, lateral margins flatly convex, posterior with pair of lobes, just lateral to junction of abdomen and genital segment. Fifth legs (fig. 27*e*) small, lobate projecting just anterior to genital segment lobe, projection bearing triangular spinule and single, naked setule; sixth legs not visible.

Female abdomen (fig. 27*c*) 1-segmented, attached to ventral surface of genital segment just anterior to apex of posterior sinus, covered by genital segment lobes. Abdomen slightly wider anteriorly than posteriorly, lateral margins flatly convex, posterior margin flat except for anal indentation. Caudal rami lobate, projecting to posterior end of genital segment, with 6 naked, spike-like setules from distal and distal inner-lateral margin. Male abdomen (fig. 27*d*) 1-segmented, distinctly divided from genital segment ventrally, indistinctly dorsally. Segment widest medially, tapered anteriorly and posteriorly. Caudal rami similar in shape to those of female, with 4 plumose setae on medial distal surface, 1 naked setule at each lateral posterior corner.

Female and male antennule (figs. 28*a–c*) 2-segmented, situated on lateral ventral cephalothoracic surface, at division between frontal region and cephalothorax. First segment almost twice the length of second, broader distally than proximally, with approximately 16 naked or lightly plumose setules from distal third of posterior and ventral surfaces. Second segment club-shaped, with approximately 9 naked setules distally, additional naked setule on distal posterolateral surface. Female and male antenna (figs. 28*a*, *b*, *d*) 3-segmented, attached medial to antennule base. First segment slightly larger than second, both irregular in outline. Length of third segment and terminal process slightly less than combined lengths of first 2 segments, third segment tapered to sharply rounded proximal end; division between third segment and terminal process distinct, slightly moreso in male than in female, terminal process strongly curved and clawlike. Two setule-like accessory processes present, 1 from middle of segment second from junction of segment and terminal process.

Female and male mandible (figs. 28*e*, *f*) rodlike, curved inwards very slightly distally, inner margin of distal region with approximately 12 denticulations. Immediately posterior and lateral to antennule base of both male and female specimens is a single, spike-shaped process comparable, in position only, to postantennular adhesion pads of *Pandarus* and comparable, in shape only, to postantennal process of caligids. Female and male postoral process

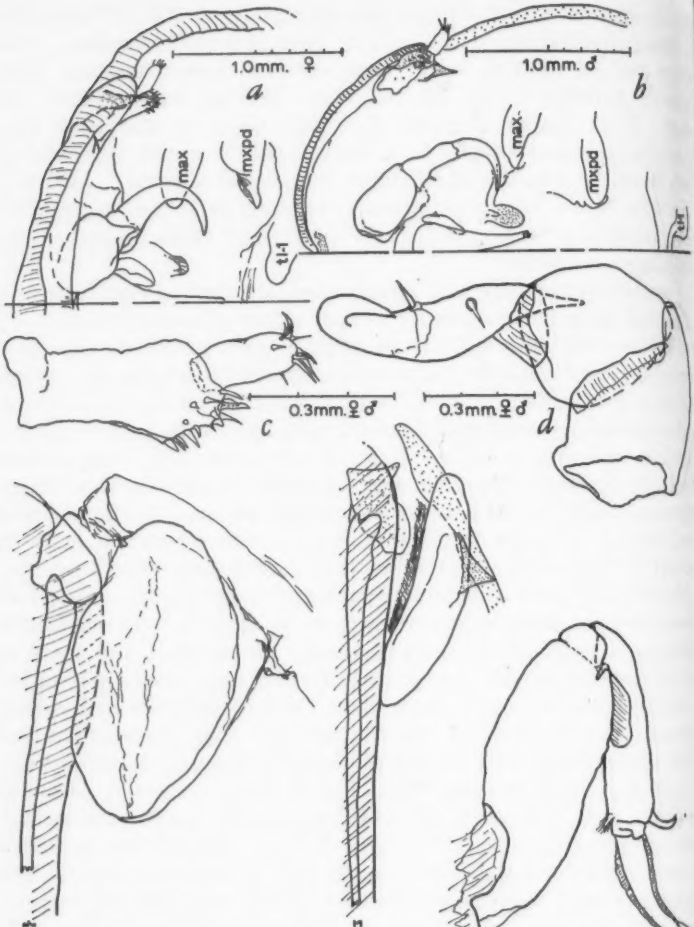

FIGURE 28.—*Nesippus crypturus* Heller, 1865: *a*, female, anterior cephalothoracic region, ventral view; *b*, male, anterior cephalothoracic region, ventral view; *c*, right antennule, ventral view; *d*, left antenna, ventral view; *e*, female, mouth cone base, mandible, and postoral process, ventral view; *f*, male, mouth cone base, mandible, and postoral process, ventral view; *g*, right maxilla, posterior view.

(figs. 28*e*, *f*) consisting of pad, immediately lateral to mouth cone, with pair of minute setules in female and subtriangular projection in male. Postoral process attached to platelike area of heavy sclerotization contiguous but not continuous with platelike area forming articulation surface for mandible. Female and male postoral adhesion pads (figs. 28*a*, *b*) lappet-like, heavily sclerotized, situated posterior and slightly lateral to postoral process.

Female and male maxilla (fig. 28*g*) 2-segmented, situated just lateral to postoral adhesion pads. First segment approximately one and one-half times the length of second, second segment slender, distal region with 1 short and 1 long, membrane-margined, saber-shaped process in addition to plumose, knob-shaped projection.

Female maxilliped (fig. 29*a*) 2-segmented, first segment appearing 2-parted and strongly developed. Proximal part broader distally than proximally, distal part large, knob-shaped, at right angles to first part, with adhesion pad distally; both parts connected, without segmental division separating them. Second segment short, irregular, situated on distal surface of knob-shaped distal part of first segment and bearing single, clawlike terminal process. Male maxilliped (fig. 29*b*) also with 2-parted first segment although second part in line with first, bearing 2 adhesion pads and spike-shaped protrusion. Second segment with distal end of clawlike terminal process denticulated. Single, setule-like accessory process at distinct division between segment and terminal process.

Thoracic legs I–IV biramous, first 3 with 2-segmented rami, fourth with 1-segmented although slight indication of segmentation present in male endopodite as indistinct line. For nature of armature and legs see tables 11–12 and figures 29*c–f*, 30*a–d*.

REMARKS.—The armature of the male thoracic legs differs from that given by Wilson (1935) although the presence of a copulating pair in the collection suggests that the male and female specimens are of the same species. Further, an examination of the males of Wilson's collection (USNM 64057) verified the identification of the male and indicated that the thoracic leg armature in table 12 is correct for the male of the species. Some variation is present, both in Wilson's collection and in the Hawaiian collection, especially in the shape of the posterior end of the male genital segment and the size of the postoral adhesion pads. The nature of the body and the appendages, especially the thoracic legs, indicates however, that the specimens in both collections are conspecific.

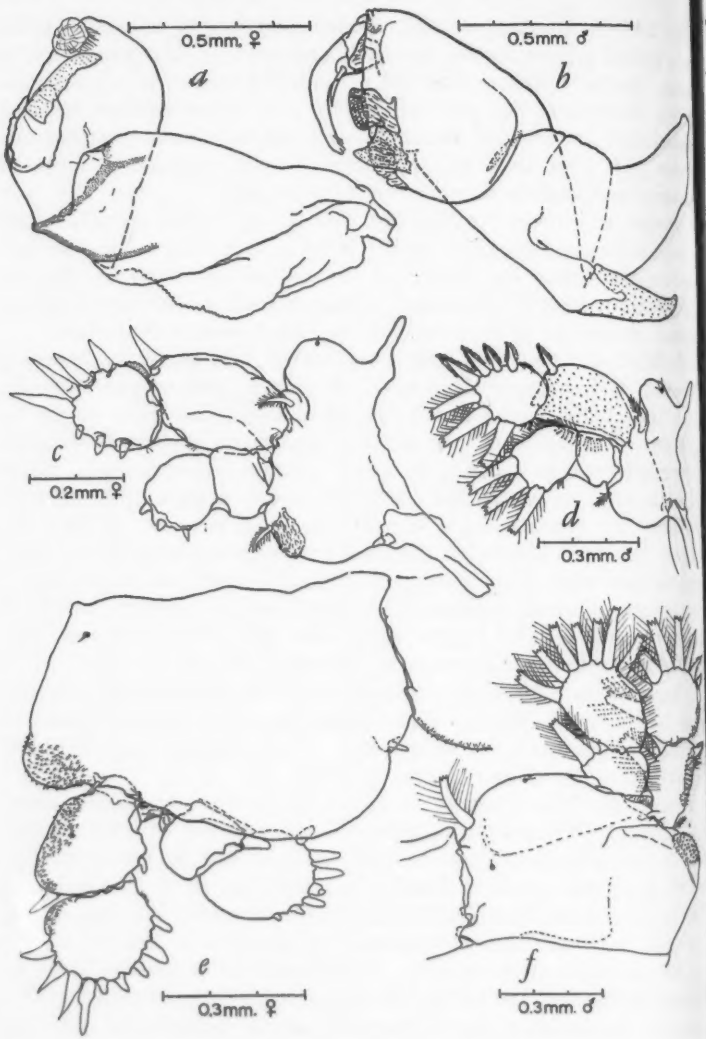

FIGURE 29.—*Nesippus crypturus* Heller, 1865. Right maxilliped: *a*, female, posteroventral view; *b*, male, anterior view. Right thoracic legs, anterior view: *c*, female, first leg; *d*, male, first leg; *e*, female, second leg; *f*, male, second leg.

TABLE 11.—*Armature of thoracic legs I–IV of the female of* Nesippus crypturus *Heller, 1865*

Leg	Surface	Interpodal Plate	Protopodite	Exopodite		Endopodite	
				1	2	1	2
I	outer		s, p	H	d, 4H		
	inner		p	c	c, 3h		3h
II	outer	d	d, p′	d, H	d, 4H		4h
	inner		h	h	c, 5h	h	3h
III	outer		2s, d, p	m, H	m, 4H		2h
	inner		h, s	c, h	4h	h	2h
IV	outer		p′	d, 4H			
	inner						

TABLE 12.—*Armature of thoracic legs I–IV of the male of* Nesippus crypturus *Heller, 1865*

Leg	Surface	Inter-podal Plate	Protopodite	Exopodite		Endopodite	
				1	2	1	2
I	outer		1sss, p	mH	d, 4mH		c, 2P
	inner		p	c	c, 3P		c, P
II	outer		s, d, p	d, c, mH	d, H, 3mH, 2P	c	c, 5P
	inner		2ss, P, 1ss	c, P	c, 3P	P	c, 2P
III	outer		d, p	s, m, H	m, 4H	c	c, B, 2P
	inner		2s, P, s	c, P	c, 4P	P	c, 2P
IV	outer		p	m, d, mh, m, 2h, H		c	
	inner		p′	c, 3P		c, P, c, 3P	

Family Trebiidae

Trebius caudatus Krøyer, 1838

FIGURES 31*a–d*, 32*a–f*

Trebius caudatus Krøyer, 1838, p. 30, pl. 1, fig. 4.—Milne-Edwards, 1840, p. 458.—Thompson, 1847, p. 248.—White, 1857, pp. 121, 317.—Krøyer, 1863, p. 149, pl. 10, fig. 1a–k.—Norman, 1869, p. 300.—Stossich, 1880, p. 257.—Valle, 1880, p. 60.—Carus, 1885, p. 360.—Bassett-Smith, 1896, p. 158; 1899, p. 461.—Scott, T. 1900, p. 155, pl. 6, figs. 20–26.—Thompson and Scott, 1900, p. 143.—Brian, 1902, p. 33.—Pearson, 1905, p. 26.—Wilson, 1907a, p. 681, pl. 15, figs. 11–13; pl. 16, figs. 14–22.—Gurney, 1934, p. 192, figs. 18–21.—Sproston and Hartley, 1941, p. 393.—Barnard, 1955, p. 255, figs. 13b–f.—Nunes-Ruivo, 1956, p. 16.

REPORTED HOSTS.—*Squalus acanthias, S. fernandinis, Dasyatis centroura, Raja batis, R. marginata.*

DISTRIBUTION.—Cosmopolitan (not reported from South Pacific).

MATERIAL.—Nine ovigerous females (USNM 110816) collected from the external surface of a "large sting ray" (probably *Aetobatus narinari*) at Coconut Island, Oahu, Hawaii.

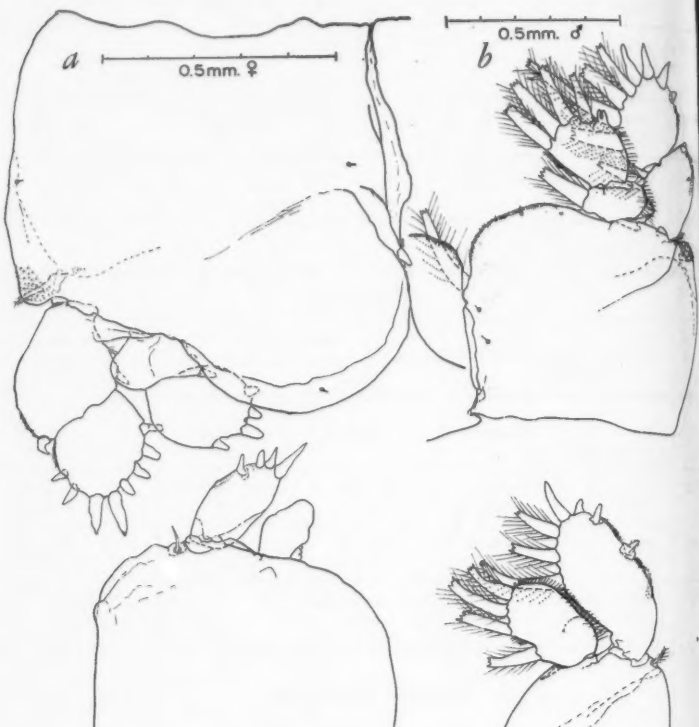

FIGURE 30.—*Nesippus crypturus* Heller, 1865, right thoracic legs: *a*, female, third leg, anterior view; *b*, male, third leg, anterior view; *c*, female, fourth leg, posterior view; *d*, male, fourth leg, anterior view.

MEASUREMENTS.—Nine female specimens:

	mean (mm.)	range (mm.)
Greatest length, excluding setae	7.59	7.00–8.45
Greatest length of cephalothorax	2.33	2.15–2.55
Greatest width of cephalothorax	2.39	2.20–2.45
Greatest length of fourth pedigerous segment	0.67	0.55–0.75
Greatest width of fourth pedigerous segment	0.71	0.40–0.80
Greatest length of genital segment	1.48	1.35–1.60
Greatest width of genital segment	1.21	1.05–1.50
Greatest length of abdomen	2.79	2.40–3.45
Greatest width of abdomen	0.43	0.40–0.45
Length of egg strings	2.41	1.55–3.10

DIAGNOSTIC DESCRIPTION OF FEMALE.—Cephalothorax (figs. 31 *a*, *b*) suborbicular, consisting of cephalic, maxilliped-bearing and first 2 pedigerous segments. Frontal region broad, with narrow membrane on anterior margin; lateral cephalothoracic margins convex, bordered by narrow membrane. Posterior end of lateral cephalothoracic regions sharply curved, inner margin free at distal end of region, attached to lateral margin of second pedigerous segment for most of its length, line of division between second pedigerous segment and rest of cephalothorax convex. Major dorsal cephalothoracic grooves extending anteriorly and slightly laterally from division between second pedigerous segment and rest of cephalothorax, terminating in anterior third of cephalothorax. Several short grooves present, projecting medially from irregularities of lateral cephalothoracic margins. Groove separating second pedigerous segment forming, with major dorsal cephalothoracic grooves, irregular H, similar to that of caligids. Second pedigerous segment broad, width more than twice the length, lateral regions projecting laterally and curving posteriorly, with membrane on inner margin of posteriorly curved portion (fig. 31*b*). Inner margin of segment forming, with outer margin of free third pedigerous segment, distinct sinus.

Third and fourth pedigerous segments (fig. 31*b*) free, width of third more than 3 times the length, separated from second pedigerous segment by flatly convex line of division dorsally. Lateral surfaces of segment irregular dorsally, forming, knob-shaped structure ventrally, similar to that found in *Dinematura latifolia*. Fourth pedigerous segment distinct from third, swollen at region of fourth leg attachment. Division between fourth pedigerous and genital segments incomplete, visible on ventral and lateral surfaces but not on dorsal surface.

Genital segment (fig. 11*c*) variable in shape, dependent upon egg content, broader posteriorly than anteriorly, anterior region forming posterior portion of necklike connection between fourth pedigerous and genital segments. Lateral posterior margin of segment with 3

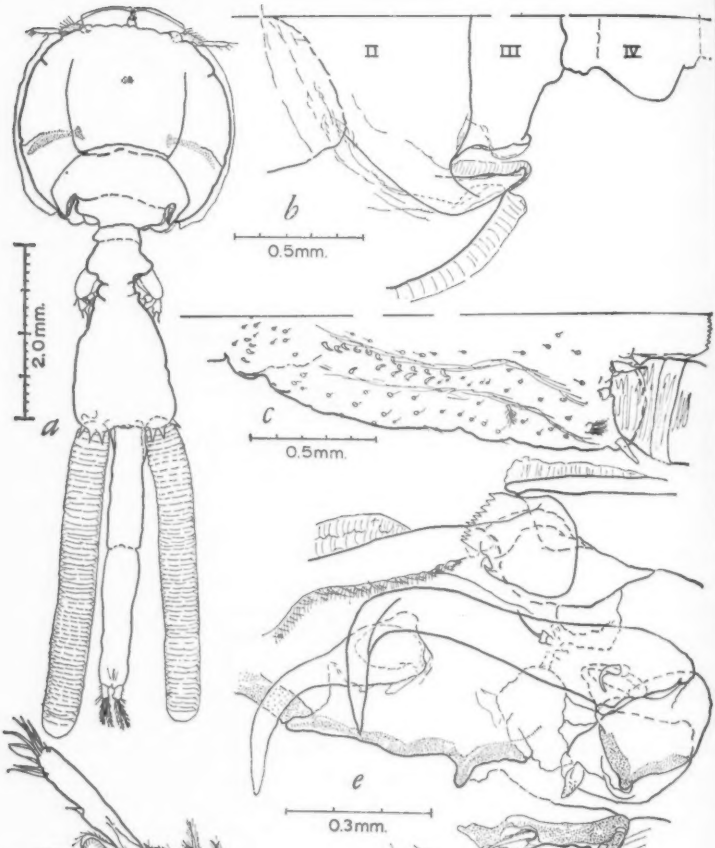

FIGURE 31.—*Trebius caudatus* Krøyer, 1838, female: *a*, dorsal view; *b*, posterior cephalothoracic region, third and fourth pedigerous segments, dorsal view (II–IV=2nd–4th pedigerous segments); *c*, genital segment, ventral view; *d*, right antennule, ventral view; *e*, right antennule base, antenna, postantennal process, mandible, postoral process, and maxilla base (max), ventral view.

spikelike processes dorsally, 1 ventrally, processes adjacent to oviducal opening. Fifth thoracic leg (presumably) a plumose setule in posterior third of genital segment, arising from swollen lateral ventral surface. Sixth leg (presumably) a nodule bearing 3 plumose setules, situated lateral and just anterior to oviducal opening. Ventral surface of genital segment with numerous minute, clawlike processes on lateral ventral surface in anterior half in addition to numerous minute, hairlike processes over most of ventral surface.

Abdomen (fig. 31*a*) elongate, 2-segmented, first segment slightly shorter than second, second segment swollen posteriorly and, in some specimens, with indistinct, incomplete line at anterior end of swelling that suggests a 3-segmented condition as described by Wilson (1907a). Abdomen distinct from genital segment dorsally, fused ventrally; posterior end of second segment angled to anal indentation. Caudal rami longer than wide, lateral margins almost parallel except at anterior and posterior ends; inner margin plumose, posterior margin irregular, posterior surface bearing 2 long, plumose setae medially, 2 short setae from outer lateral surface and 1 minute setule from inner surface. Both abdomen and caudal rami with numerous minute, hairlike projections.

Antennule (figs. 31*d*, *e*) 2-segmented, attached to lateral-anteroventral cephalothoracic surface. Second segment slightly less than three-fourths the length of first, first broader proximally than distally, with ridge along most of ventral surface bearing approximately 19 plumose setae. Second segment elongate, slightly narrower proximally than distally, bearing single naked setule from middle of posterior surface, 10 naked setules from distal surface. Antenna (fig. 31*e*) 3-segmented, attached posterior and medial to antennule base. First and second segments short, irregular, combined lengths approximately one-third the length of third segment and terminal process; first segment with small, conical process bearing minute plumosites. Third segment and terminal process fused, forming long, claw-shaped structure, with 2 setule-like accessory processes, proximalmost appearing finely plumose. Mandible (fig. 31*e*) rod-shaped, slightly swollen proximal end articulating in platelike region of heavy sclerotization. Distal end of mandible flattened, curved medially, inner margin with 12 denticulations. Postantennal process (fig. 31*e*) long and clawlike, situated lateral to antenna base and posterior and lateral to antennule base, without process-bearing nodules present on euryphorids and caligids. Postoral process (fig. 31*e*) 2-parted, appearing to originate from platelike area of hairy sclerotization forming articulation surface for mandible. Posterior part of process elongate, bifurcate distally, outer tine longer than inner; anterior part a nodule bearing single, naked setule. Maxilla 2-segmented, situated posterior

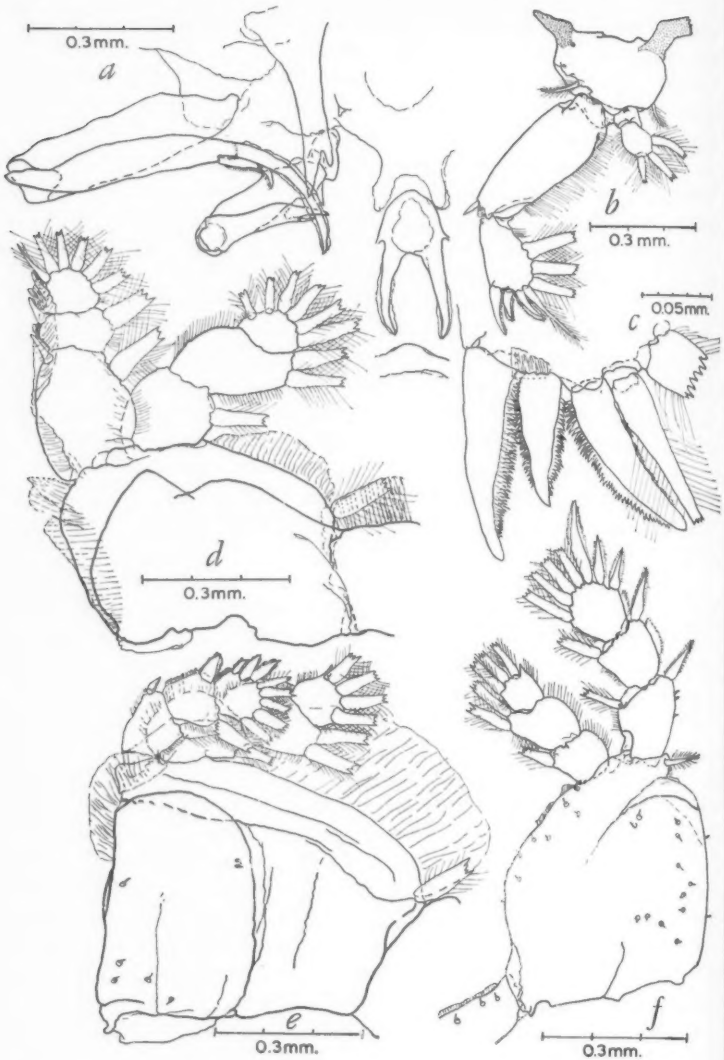

FIGURE 32.—*Trebius caudatus* Krøyer, 1838, female. Postoral process, maxilla, maxilliped, sternal furca: *a*, ventral view. Right thoracic legs: *b*, first leg, anterior view; *c*, distal region of second segment of exopodite of first leg, anterior view; *d*, second leg, posterior view; *e*, third leg, posterior view; *f*, fourth leg, anterior view.

and lateral to postoral process. First and second segments of approximately equal length, first more strongly developed, with tapered and curved proximal end forming articulation and muscle attachment surface; second segment elongate, narrower proximally than distally, with pair of saber-shaped terminal processes, inner approximately twice the length of outer, with pair of fine, filmy membranes, outer terminal process with fuzzy membrane along inner and outer lateral margins.

Ventral surface of cephalothorax with several irregularities, 2 of notable value. First a lobate projection (fig. 31*e*) of heavily sclerotized ridge extending laterally from base of antenna. Second a pair of minute, subtriangular projections (fig. 32*a*) between maxilla bases and just anterior and medial to maxilliped bases, in region of postoral adhesion pads found in pandarids, euryphorids and some caligids.

TABLE 13.—*Armature of thoracic legs I–IV of the female of* Trebius caudatus *Krøyer, 1838*

Leg	Surface	Interpodal Plate	Protopodite	Exopodite			Endopodite		
				1	2	3	1	2	3
I	outer		p	h	3dmH			c, 2P	
	inner		p	c	c, 4P			P	
II	outer	m	m, p	m, fmH	m, fmH	m, fmH, 3P	c	c	c, 3P
	inner		P, m	c, P	c, P	c, 3P	P	c, 2P	3P
III*	outer		m, p	c, fmH	fm, fmH	fm, 3fmH, 2P	c	c	c, rh, 2P
	inner		P, m	c, P	c, P	c, 3P	P	c, 2P	c, 2P
IV*	outer		c, p	5s, fmH	fm, fmH	fm, 3fmH	c	c	c, rh, P
	inner		fm	c, P	c, P	c, 4P	P	c, 2P	c, 2P

*Small, hairlike spicules on protopodite and exopodite not included.

Maxilliped (fig. 32*a*) 2-segmented, situated posterior and medial to maxilla base. First segment longer than second, with spikelike projection from posteroproximal surface. Second segment slender, tapered slightly from proximal to distal regions, with small, clawlike terminal process distinct from segment, also with setule-like accessory processes adjacent to terminal process. Sternal furca (fig. 32*a*) large, situated between and slightly posterior to maxilliped bases, consisting of anteriorly rounded, heavily sclerotized plate bearing pair of slightly diverging tines, tines approximately one and one-fourth times the length of plate.

Thoracic legs I–IV biramous, protopodite 1-segmented, rami of first leg 2-segmented, of others 3-segmented. For nature of armature and legs see table 13 and figures 32*b–f*.

Family Euryphoridae

Alebion echinatus Capart, 1953

FIGURES 33*a–c*, 34*a–e*, 35*a–g*

Alebion enchinatus Capart, 1953, p. 655, fig. 4.—Shiino, 1955a, p. 177, figs. 1–3.—Vaissière, 1959, p. 544, fig. 5.

REPORTED HOSTS.—*Sphyrna diplana, S. zygaena.*

DISTRIBUTION.—Gulf of Sénégal, Japan.

MATERIAL.—One nonovigerous adult female (USNM 110817) collected by the author from the external surface of a specimen of *Galeocerdo cuvier* collected by Lester Zukeran in Kaneohe Bay, Oahu, Hawaii. Two ovogerous and 1 nonovigerous adult females (USNM 110818) collected by the author from the external surface of a specimen of *Sphyrna lewini* collected by Lester Zukeran in Kanoehe Bay, Oahu, Hawaii.

MEASUREMENTS.—Four female specimens:

	mean (mm.)	*range (mm.)*
Greatest length, excluding setae	15.16	14.35–15.89
Greatest length of cephalothorax	8.03	7.49– 8.54
Greatest width of cephalothorax excluding marginal flange	9.03	8.75– 9.24
Greatest length of genital segment excluding posterior processes	4.87	4.48– 5.25
Greatest width of genital segment	5.76	5.53– 6.09
Greatest length of genital segment processes	2.94	2.87– 3.01
Greatest length of abdomen	1.58	1.33– 1.75
Length of egg strings (2 specimens)		20.65, 21.00

DIAGNOSTIC DESCRIPTION OF FEMALE.—Cephalothorax (fig. 33*a*) suborbicular, consisting of cephalic, maxilliped-bearing and first three pedigerous segments. Frontal region distinct, with very narrow, membranous flange projecting posteriorly from ventral-lateral anterior surface; lateral cephalothoracic margins with sharp indentation anteriorly, at junction with groove separating frontal region from rest of cephalothorax. Lateral cephalothoracic margins with membranous flange extending posteriorly, around posterior extensions of lateral cephalothoracic regions, terminating at beginning of U-shaped posterior sinuses. Posterior sinuses each with heavily sclerotized ridge along most of outer lateral margin, also with 2 membranes, 1 extending posteriorly from outer posterior end of each sinus, second extending along outer lateral margin (fig. 33*b*). Posterior end of median cephalothoracic region with 10 poorly sclerotized spinules and pair of small, platelike projections dorsally, just medial to spinules, projections covering lateral regions of short, necklike extension joining free fourth pedigerous segment with cephalothorax.

Dorsal cephalothoracic grooves distinct, forming irregular H, cross groove of H in posterior half of cephalothorax, joined to anterior longitudinal grooves at anterior end of sclerotized ridge projecting anteriorly from posterior sinus. Anterior longitudinal grooves

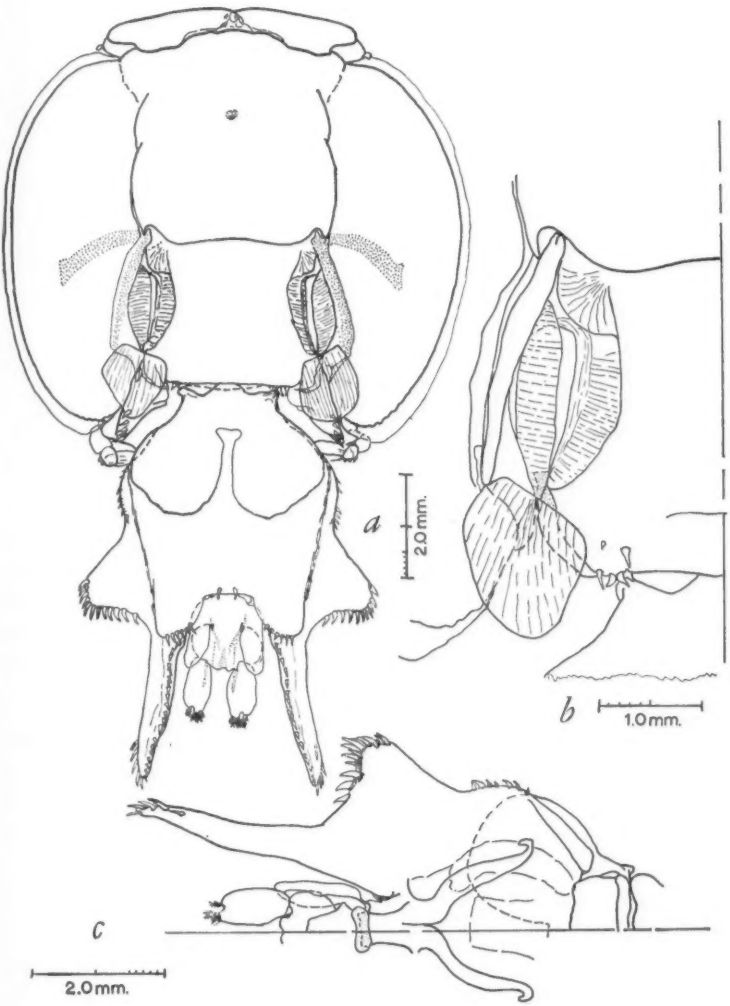

FIGURE 33.—*Alebion echinatus* Capart, 1953, female: *a*, dorsal view; *b*, region of cephalothoracic sinus, dorsal view; *c*, fourth pedigerous segment, genital segment, abdomen, and caudal ramus, ventral view.

wavy, extending to ocular region, terminating in close proximity to small grooves proceeding posteriorly from indentation of lateral cephalothoracic margin. Eyes distinct, small, with small orbicular crystalline body at outer edge of suborbicular region of dark pigment, pigmented region contiguous on median longitudinal axis of cephalothorax.

Free fourth pedigerous segment (fig. 33*c*) narrow, slightly more than one-fifth the width of cephalothorax, distinct from genital segment and cephalothorax. Segment with posteriorly bilobed ala overlapping anterior region of genital segment dorsally, sinus between lobes, deep, enlarged at apex.

Genital segment (fig. 33*c*) broader anteriorly than medially, with 2 winglike expansions posteriorly. Median posterior surface forming broadly U-shaped sinus dorsally, with 2 spinules from middle of sinus apex. Lateral posterior surfaces, medial to wing-shaped expansions, rounded, overlapping posterior processes, with 6 clawlike marginal spinules. Segment with pair of heavily sclerotized processes posteriorly, processes projecting well past caudal rami, with spine-bearing ridge on inner dorsal surface. Distal end of processes spined on outer and inner margins. Ventral surface of genital segment with lyre-shaped process directed ventrally and anteriorly from origin in posterior region of segment. Shiino (1955a, p. 179) terms this structure "a pair of horn-like spermatophores . . . ."

Abdomen (fig. 33*c*) termed 2-segmented by Capart (1953) and Shiino (1955a) although segment division indistinct and incomplete. Abdomen arising in apex of posterior sinus of genital segment, from posterior end of short, necklike extension of genital segment. First segment, excluding winglike projections, 3 times as wide as long, winglike extensions directed posteriorly, curving around and covering lateral regions of second segment. Second segment slightly narrower than first, length approximately five-eighths the width, lateral regions convex, posterior end with distinct, concave anal depression. Caudal rami (fig. 34*e*) flattened except for small, heavily sclerotized ridge along proximal inner surface. Lateral margins flatly convex, inner lightly plumose distally, posterior surface irregular, with 4 plumose setae, 1 plumose setule and 1 bluntly pointed spicule.

Antennule (fig. 34*a*) 2-segmented, first segment approximately five times the length of second, broad and flattened, distal third broadly rounded although margin slightly wavy, bearing 20 subconical plumose setules and 2 more elongate plumose setules. Second antennular segment club-shaped, with 10 naked setules distally. Antenna (fig. 34*b*) 3-segmented, situated posterior and medial to antennule base; first segment broader proximally than distally, with knob on proximal-outer lateral surface, second segment narrow proximally, broad

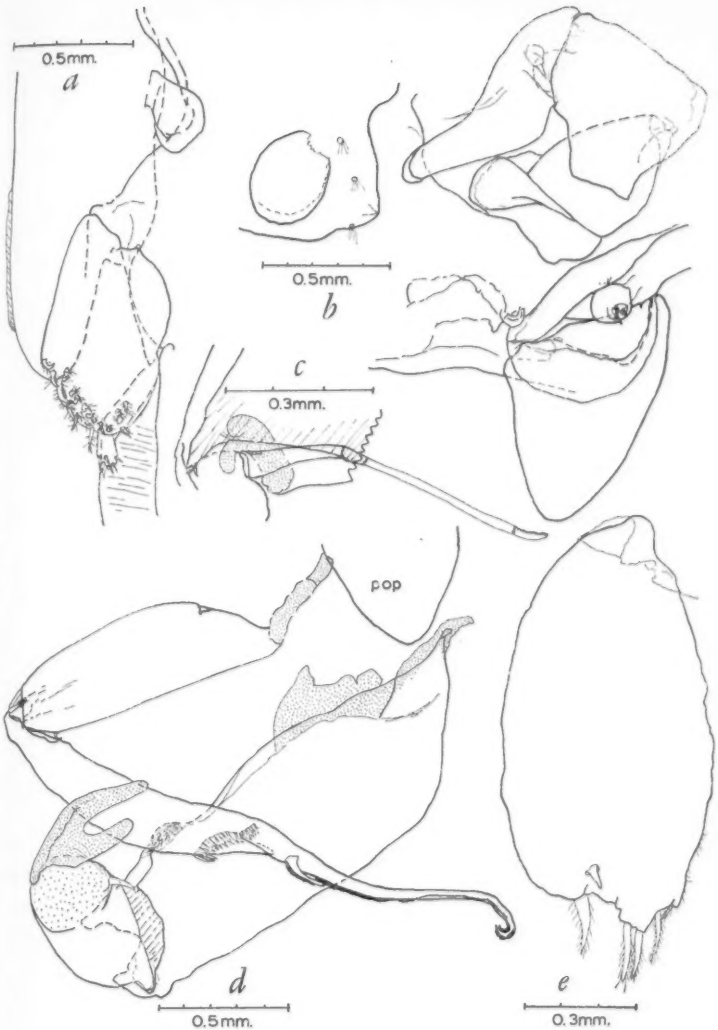

FIGURE 34.—*Alebion echinatus* Capart, 1953, female: *a*, right antennule, ventral view; *b*, right postantennal process, antenna, and postoral process, ventral view; *c*, right mandible, anterior view; *d*, right maxilla and maxilliped, ventral view (pop=postoral process); *e*, left caudal ramus, dorsal view.

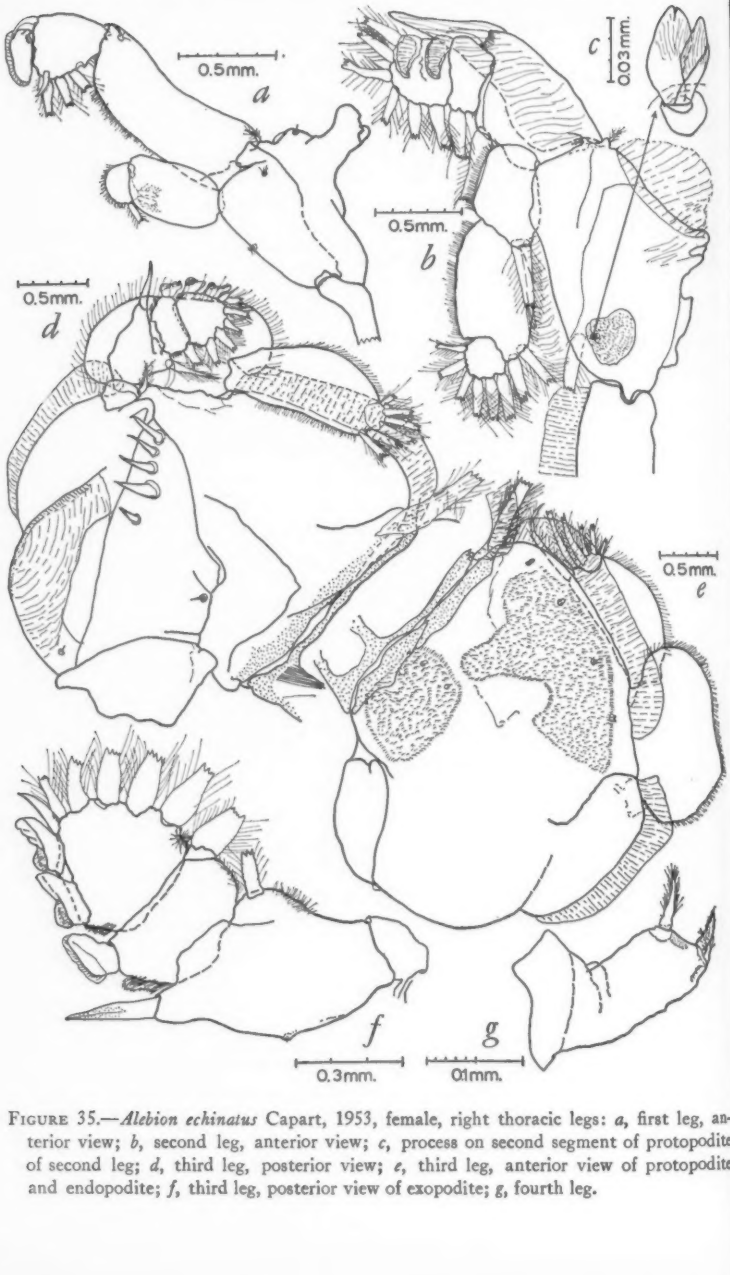

FIGURE 35.—*Alebion echinatus* Capart, 1953, female, right thoracic legs: *a*, first leg, anterior view; *b*, second leg, anterior view; *c*, process on second segment of protopodite of second leg; *d*, third leg, posterior view; *e*, third leg, anterior view of protopodite and endopodite; *f*, third leg, posterior view of exopodite; *g*, fourth leg.

medially and sharply curved so that distal surface at right angles to proximal. Third segment and terminal process continuous, forming strongly developed, heavily sclerotized claw bearing 2 small accessory processes; first process a spinule from knob in proximal region, second a slender setule from middle of combined segment and terminal process. Mandible (fig. 34*c*) 4-parted, distal part short, curved inward slightly, with 12 minute denticulations along inner surface. Postantennal process (fig. 34*b*) a suborbicular adhesion pad and 3 nodules, each bearing several hairlike processes, pad situated lateral to base of antenna. Postoral process (fig. 34*b*) situated lateral to

TABLE 14.—*Armature of thoracic legs I–IV of the female of* Alebion echinatus *Capart, 1953*

Leg	Surface	Interpodal Plate	Protopodite	Exopodite			Endopodite		
				1	2	3	1	2	3
I	outer		p, 1sss	rh	H, mH′			c	
	inner		p	c	3P, p, h			3P, c	
II	outer	m	m, p	m, mfH	mH	mH, 2P	c	c	c, 3P
	inner		P, b*,m	c, P	c, P	c, 4P	P	c, 2P	3P
III	outer**	m	s, a, m, p	s, H	C, mH	C, 2mH, H	c	c	2P
	inner**		P, m4b*	c, P	c, P	c, 5P		c, 2P	2P
IV	outer			3p***					

* Small, bilobed membranous process presumably modified from hairlike processes normal to members of the genus.
** Only marginal armature included.
*** The origin of the armature elements is presumed to be the exopodite.

mouth cone, consisting of 2 parts. Posteriormost part a broad, heavily sclerotized, subtriangular projection, anterior part a node bearing 2 slight swellings distally, each with flabby, setule-like process. Maxilla (fig. 34*d*) 2-segmented, situated posterior and lateral to postoral process, both segments of about equal length although first more strongly developed, broader proximally than distally. Second segment narrow proximally, broader distally, with row of spinules on posterior distal surface, long, whiplike terminal process with frilled margins and short, dagger-like terminal process, also with frilled margins.

Maxilliped (fig. 34*d*) 2-segmented, situated posterior and medial to maxilla base. First segment strongly developed, slightly less than twice the length of second segment and terminal process, with narrow proximal end, small concavity of inner medial surface, and small, knoblike adhesion process just distal to concavity. Second segment short and chunky, divided, by regions of sclerotization, from bifurcate

terminal process and bearing either naked or very lightly plumose spinelike accessory process on inner surface, proximal to terminal process.

Thoracic legs I–III biramous, leg IV uniramous and poorly developed. For nature of armature and legs, see table 14 and figure 35.

Alebion gracilis Wilson, 1905

FIGURES 36*a–c*, 37*a–d*, 38*a–e*

Alebion gracilis Wilson, 1905a,[4] p. 128; 1907a, p. 704, pl. 18, figs. 35–48; 1932, p. 420, fig. 264.—Shiino, 1959a, p. 316, figs. 19–21.

REPORTED HOSTS.—*Mustelus canis*, *Carcharias taurus*, *Carcharhinus obscurus*, *Carcharhinus platyrhynchus*, *Carcharhinus lamiella*, *Squalus acanthias*, "*Trygon*" species, *Pollachius virens*, "Bonito."

DISTRIBUTION.—Revillagigedo Islands, Woods Hole Region. (Wilson, 1907a lists the cotypes as coming from Clarion Island, a member of the Revillagigedo Islands.)

MATERIAL.—Three ovigerous and 2 nonovigerous adult females (USNM 110819) collected by Susumo Kato from the external surface of several specimens of sharks (no identification made) captured by longline off Oahu, Hawaii.

MEASUREMENTS.—Five female specimens:

	mean (*mm.*)	*range* (*mm.*)
Greatest length	9.66	9.31–10.01
Greatest length of cephalothorax	4.72	4.55– 4.83
Greatest width of cephalothorax, excluding marginal flanges	4.65	4.41– 4.90
Greatest length of genital segment, excluding posterior processes	2.66	2.45– 3.01
Greatest width of genital segment	2.73	2.66– 2.80
Greatest length of genital segment processes	1.60	1.54– 1.68
Greatest length of abdomen	1.12	1.05– 1.26
Egg string length (3 specimens)	5.72	4.55– 7.00

DIAGNOSTIC DESCRIPTION OF FEMALE.—Cephalothorax (fig. 36*a*) ovoid, consisting of cephalic, maxilliped-bearing and first 3 pedigerous segments. Frontal region distinct, with narrow membranous flange projecting posteriorly from anteroventral surface, lateral cephalothoracic margins with distinct indentation at anterior end, with narrow membranous flange extending along most of margin and around broadly curved posterolateral cephalothoracic region, terminating at beginning of U-shaped posterior sinus. Posterior sinus with 2 membranes, 1 extending posteriorly from outer posterior end of sinus, second extending along outer lateral margin. Posterior end of median cephalothoracic region with 8 spines. Major dorsal

[4] The author used the name *A. gracile* but, in 1907a, corrected the improper latinization of the term to *A. gracilis*.

cephalothoracic grooves forming irregular H, cross groove in posterior third of cephalothorax; anterior longitudinal grooves extending anteriorly, in irregular manner, to ocular region, turning laterally abruptly and terminating at indentation of anterior lateral cephalothoracic margin. Eyes distinct, with two small orbicular crystalline body at outer edge of regions of dark pigmentation, pigmented regions contiguous on median longitudinal axis of body.

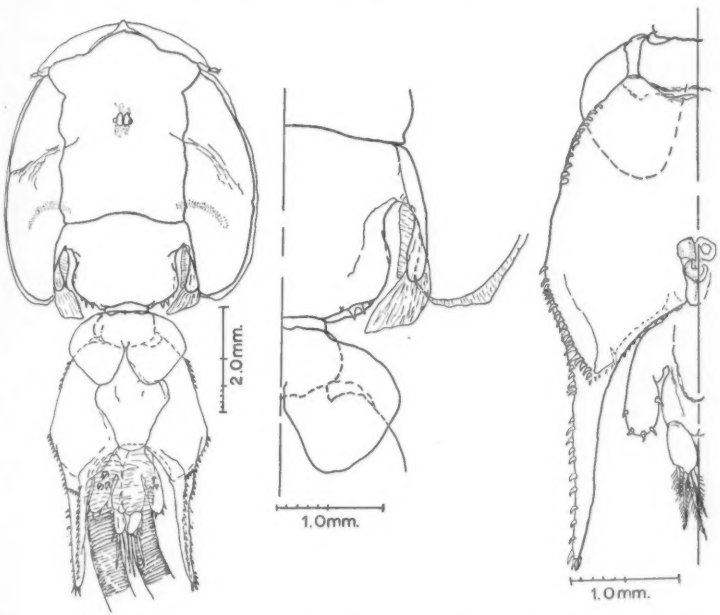

FIGURE 36.—*Alebion gracilis* Wilson, 1905, female: *a*, dorsal view; *b*, posterior cephalothoracic region and fourth pedigerous segment, dorsal view; *c*, fourth pedigerous segment, genital segment, abdomen, and caudal ramus, ventral view.

Free fourth pedigerous segment (figs. 36*b*, *c*) narrow, slightly less than one-fourth the width of cephalothorax, distinct from cephalothorax and genital segment, attached to short, necklike extension of median cephalothoracic region. Segment with pair of alae projecting posteriorly from dorsal surface, covering anterior end of genital segment. Wilson (1932) indicates that the distal ends of the alae are squarely truncated. The inner margins of the alae are basically flat, giving the form figured by Wilson (1907a, 1932) but the distal ends are sharply rounded, not truncated.

Genital segment (fig. 38*c*) of general heart-shape with posterior end forming sinus. Anterior lateral margins with row of spinules. Pair

of long, subconical projections extending from posterolateral surfaces, projecting posteriorly well past caudal rami, with heavily sclerotized, spinule-bearing ridge extending along dorsal surface of process, continuing, without spinules, along margin of medial posterior end of genital segment. Outer margin of process usually with some spinules although number variable, from the more heavily spined condition shown in figures 36*a*, *c* to a condition in which there are few or, in one specimen, no spinules along the medial outer margin. Posterior end of process sharply rounded, with cluster of 4 spinules, somewhat larger than those along outer margin.

Abdomen (fig. 36*c*) 2-segmented although fusion of segments evident, attached to posterior surface of genital segment, at apex of median depression. First segment approximately equal to length of second, with pair of long, lobate extensions projecting laterally then curving posteriorly and extending to end of abdomen, projections with spinules scattered over dorsal surface and margin (not mentioned by either Wilson or Shiino). Second segment widest medially, lateral margins convex, posterior angled to anal indentation. Caudal rami slightly less than twice as long as wide, narrower proximally than medially, slightly tapered to distal end, bearing 4 plumose setae and 2 setules, 2 of the setae originating from small, knoblike projection of medial distal surface.

Antennule (fig. 37*a*) 2-segmented, first segment slightly less than 3 times the length of second, narrow proximally, broadest medially, slightly narrower distally, anteroventral and distal-ventral surface with approximately 19 naked or very lightly plumose setules. Second segment club shaped, with 8 naked setules distally. Antenna (fig. 37*b*) situated posterior and medial to antennule base, appearing 4-segmented although nature of musculature (partially shown in fig. 37*b*) suggests either secondary division (or incomplete fusion) of proximal 2 parts or that first part a projection of cephalothorax. Penultimate segment large, oval; distal segment and terminal process slightly shorter than penultimate, segment not distinct from distally curved terminal process. Accessory processes 2 in number, 1 long, setule-like process arising from middle of fused segment and terminal process, second short and knoblike, situated at proximal end of segment.

Mandible (fig. 37*b*) rodlike, appearing 4-parted, distal part bluntly rounded distally, inner margin with 12 denticulations. Postantennal process (fig. 37*b*, "pap") a small adhesion pad lateral and slightly posterior to antenna base, with 3 nodules, bearing hairlike projections, just medial to pad. Postoral process (fig. 37*b*) 2-parted, posterior part a broad, padlike structure with narrow membrane along distal surface, anterior part a node bearing 3 projections, each with single

setule. Heavily sclerotized regions underlying both mandible and postoral process not appearing continuous. Pair of small, postoral adhesion pads (fig. 37*c*) present just posterior to postoral process, between and slightly posterior to maxilla bases.

Maxilla (fig. 37*c*) 2-segmented, situated just posterior and lateral to postoral process. First segment slightly more than two-thirds the

FIGURE 37.—*Alebion gracilis* Wilson, 1905, female, ventral view: *a*, right antennule; *b*, left antenna, postantennal process (pap), mouth cone (mc), mandible, and postoral process; *c*, left postoral process (pop), maxilla, and maxilliped base (mxpd); *d*, left maxilla base (max) and maxilliped.

length of second, with small, knoblike projection proximally, forming articulation and muscle attachment surface. Second segment elongate, narrower proximally than medially, tapered to narrow distal end, with small membrane arising from middle of segment and 2 saber-shaped terminal processes from distal end. Innermost terminal process

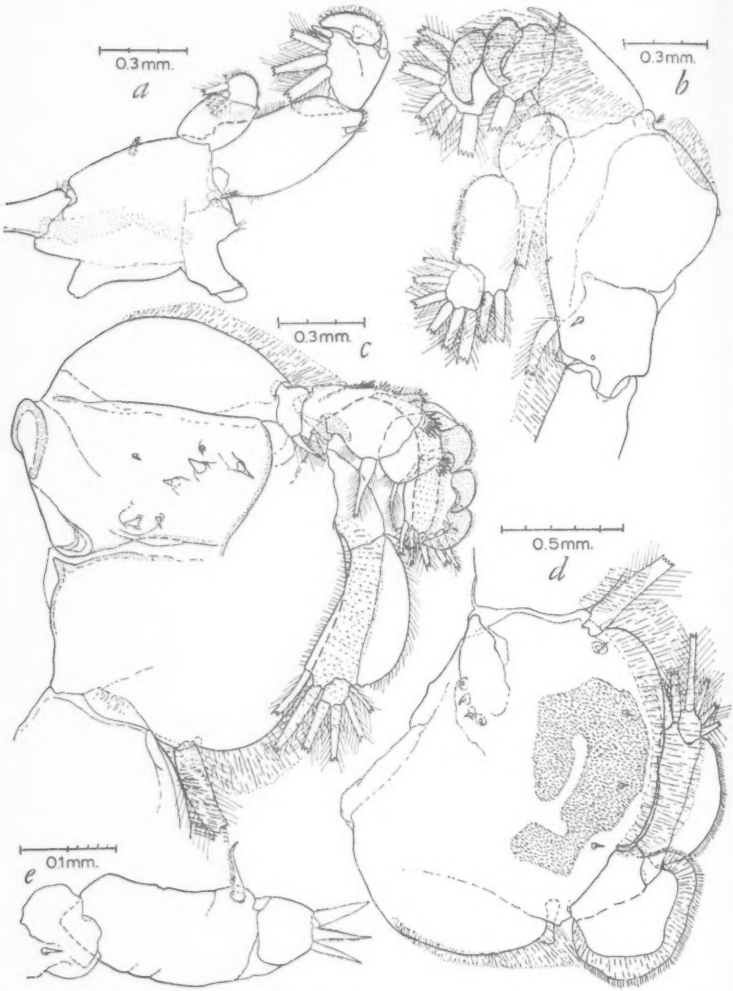

FIGURE 38.— *Alebion gracilis* Wilson, 1905, female, right thoracic legs: *a*, first leg, anterior view; *b*, second leg, anterior view; *c*, third leg, posterior view; *d*, third leg, anterior view; *e*, fourth leg, anterior view.

almost twice the length of outer, with fine membranous margin along inner surface, outer process with frilled membrane along outer and inner surface.

Maxilliped (fig. 37*d*) 2-segmented, situated immediately posterior and medial to maxilla base. First segment approximately 3 times the length of second, tapered to sharply rounded articulation and muscle attachment surface proximally, widest medially, with small, knoblike protrusion on distal outer surface. Second segment and terminal process claw shaped, terminal process bluntly pointed distally; accessory process setule-like, located at indistinct division between segment and terminal process.

Thoracic legs I–III biramous and well developed, thoracic leg IV uniramous and poorly developed. For the nature of the armature and the legs, see table 15 and figure 38.

TABLE 15.—*Armature of thoracic legs I–IV of the female of* Alebion gracilis *Wilson, 1905*

Leg	Surface	Interpodal Plate	Protopodite	Exopodite			Endopodite		
				1	2	3	1	2	3
I	outer inner		1ss, p p	h, c c	H, mH 3P, p, H			c 3P	
II	outer inner	m	m, p P, 2rh, m	m, dfH c, P	mH c, P	mH, *, 3P c, 3P	c P	c c, 2P	c, 4P c, 2P
III	outer** inner**		m, p P, m, 3rh	c, 4rh, fH c, P	dm, c, mH c, P	dm, 2mH, p, 2P 3P	c	c c, 2P	3P P
IV	outer inner		p	2h h					

*Shiino indicates the presence of a spinule that was not found on the Hawiian specimens although there was a heavily sclerotized projection extending into the large, curved spine (mH).
**Includes only marginal armature.

Order Lernaeopodoida

Family Sphyriidae

Paeon vaissierei(?) Delamare-Deboutteville and Nunes-Ruivo, 1953

FIGURES 39*a–f*, 40*a–h*

Paeon vaissierei Delamare-Deboutteville and Nunes-Ruivo, 1953a, p. 161, fig. 15.

REPORTED HOST.—*Sphyrna couardi.*

DISTRIBUTION.—Sénégal.

MATERIAL.—One complete ovigerous female, two incomplete ovigerous females and one mature male (USNM 110820) collected by author from gill cavity of specimen of *Sphyrna lewini* captured by longline by Lester Zukeran in Kaneohe Bay, Oahu, Hawaii.

MEASUREMENTS.—One complete, two incomplete females (male not measured):

	mean (mm.)	range (mm.)
Greatest length, excluding caudal filaments (1 specimen)	21.84	
Greatest length of cephalothorax (1 specimen)	4.27	
Greatest width of cephalothorax (1 specimen)	5.25	
Greatest length of neck (1 specimen)	7.42	
Greatest length of trunk or genital segment (3 specimens)	11.29	10.64–12.04
Greatest width of trunk or genital segment (3 specimens)	3.38	2.87– 3.64
Greatest length of caudal filaments (2 specimens)		11.34, 10.71
Length of egg strings (3 specimens)	18.08	16.66–19.39

DIAGNOSTIC DESCRIPTION OF FEMALE.—Body (fig. 39*a*) divisible into 3 regions, multilobed anterior region (cephalothorax), elongate neck, and irregular trunk (genital segment). Trunk with small, bilobed abdomen posteriorly, abdomen with pair of smooth elongate processes (caudal filaments) whose place of origin suggests possible association with the caudal rami.

Cephalothorax (fig. 39*b*) and most of neck embedded in host, cephalothorax consisting of 2 large knobs forming anterior region; single flaplike lobe arising from posteromedian dorsal surface of knobs and projecting posteriorly over anterior end of neck; 6 pairs of knobs arising from ventral surface. Anteriormost pair of ventral knobs almost contiguous on median longitudinal axis, overlapping oral region. Neck 2-parted, slender, width approximately one-eighth that of cephalothorax although varying somewhat throughout length. Anteriormost part of neck less than twice the length of posterior, appearing as extension of median posterior cephalothoracic surface; second part appearing as extension of trunk. Trunk narrower anteriorly than posteriorly, with constrictions on anterior end giving annulated appearance. Lateral margins irregular; posterior end (fig. 39*c*) with distinct sinus medially, slightly projecting lateroposterior regions rounded. Single abdominal segment (fig. 39*c*) arising at apex of sinus, not projecting past lateroposterior regions of trunk, posterior end indented at anal opening, with pair of caudal filaments arising from dorsal surface. Caudal filaments slightly shorter than trunk, rod-shaped, without distinct irregularities. Egg strings projecting from oviducal openings situated just lateral to abdomen, on lateral surfaces of sinus in posterior end of trunk.

Appendage complement consisting of pair of mandibles, 2 pairs of maxillae (using Wilson's 1919 appendage designation) and pair of small, irregular processes, posterior to maxillae, that may be maxillipeds. Mandibles (fig. 39*d*) minute, rodlike, structural details not determined. Maxillule (?) (fig. 39*d*) minute, situated just lateral to

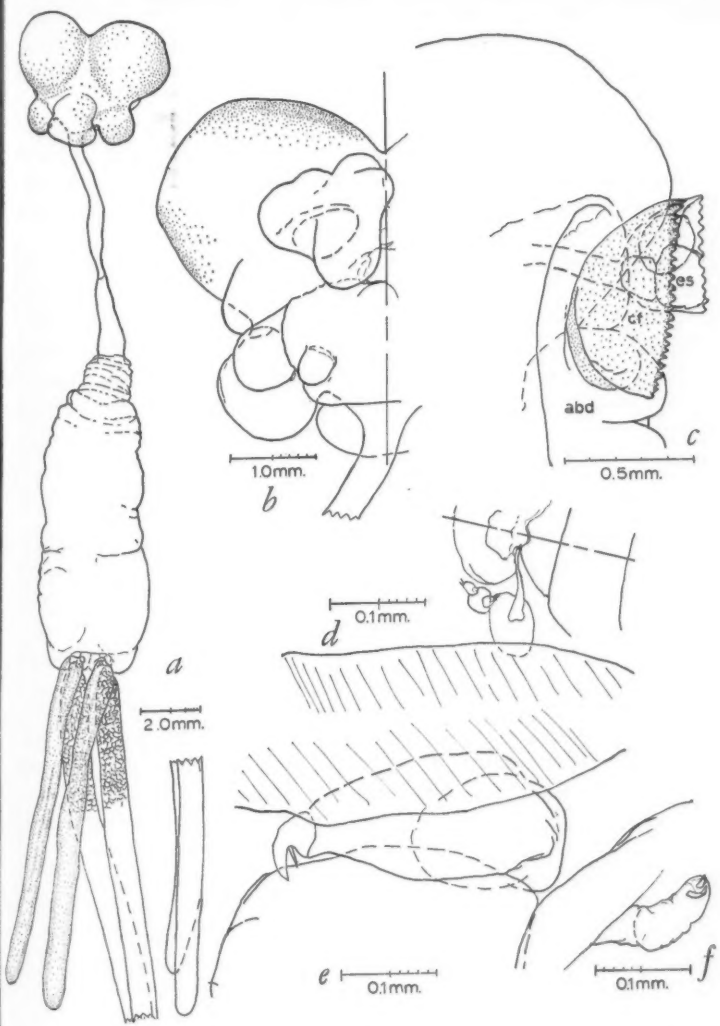

FIGURE 39.—*Paeon vaissierei* Delamare-Deboutteville and Nunes-Ruivo, 1953, female: *a*, dorsal view; *b*, cephalothorax and anterior neck region, ventral view; *c*, posterior end of trunk, anterior end of egg string (es), abdomen (abd), and caudal filament (cf), dorsal view; *d*, mouth cone, mandible, and maxillule (?), ventral view; *e*, maxilla (?), ventral view; *f*, maxilliped (?), ventral view.

base of mouth cone and posterior to mandible base, consisting of 1-segmented, knoblike protopodite and 1-segmented endopodite and exopodite, each ramus with minute, hairlike processes. Maxillae (?) (fig. 39*e*) 2-segmented, situated posterior to mouth cone base, first segment strongly developed, second and terminal process claw-shaped, with single, spikelike accessory process. Maxillipeds (?) (fig. 39*f*) attached to lobe lateral and posterior to maxillae, consisting of 2 indistinctly separated segments, second tipped by 2 minute, clawlike processes.

DIAGNOSTIC DESCRIPTION OF MALE.—Attached to posterior medial surface of female. Body (fig. 40*a*) of copepodid shape, separable into 2 regions although external indication of body segmentation faint. Anterior region (cephalothorax) composed of cephalon and maxilliped-bearing segment according to Wilson's terminology (1919). Posterior region (urosome) consisting of 5 indistinctly separable segments, separated from cephalothorax by incomplete division and by size. Diameter of urosome less than that of cephalothorax. Posterior region with 2 pairs of small, lobate processes on fourth segment and pair of somewhat longer caudal rami (fig. 40*h*) on last segment.

Cephalothorax of general ovoid shape in lateral view, anteroventral surface depressed giving impression that dorsal and lateral cuticle form carapace-like covering. Antennule (fig. 40*b*) 2-segmented, situated on anterolateral cephalothoracic surface; second segment approximately three-fourths the length of first, not as well developed. First segment with single setule on distal anterolateral surface, second segment with single weak setule and 2 spikelike setules from distal surface. Antenna (fig. 40*c*) situated posterior and slightly medial to antennule, 4-segmented; first segment well developed, broader proximally than distally, second segment with large lobate projection anteriorly giving bifurcate appearance to appendage, projection with 3 small, spikelike processes distally and with denticulated inner margin. Third segment denticulated along posterior surface, fourth segment short, with well-developed, clawlike spine, 2 simple spines and denticulated knob, all on distal surface. Mandible (fig. 40*d*) rodlike, composed of at least 3 parts; proximal part broad, tapered distally, second and third parts also tapered, third with denticulated inner margin distally. Mouth cone (fig. 40*a*) short, arising from depression in anterior ventral cephalothoracic surface, distal end fringed with plumosities. Maxillule (?) (fig. 40*e*) arising from ventral cephalothoracic surface posterior to mandible and adjacent to mouth cone, composed of 2 subequal segments, first overlapping second distally, with flimsy, conical process on distal outer surface; second segment with 3 flimsy, conical processes on distal outer and distal surfaces, all processes indistinctly separable from segments. Maxilla (?) (fig.

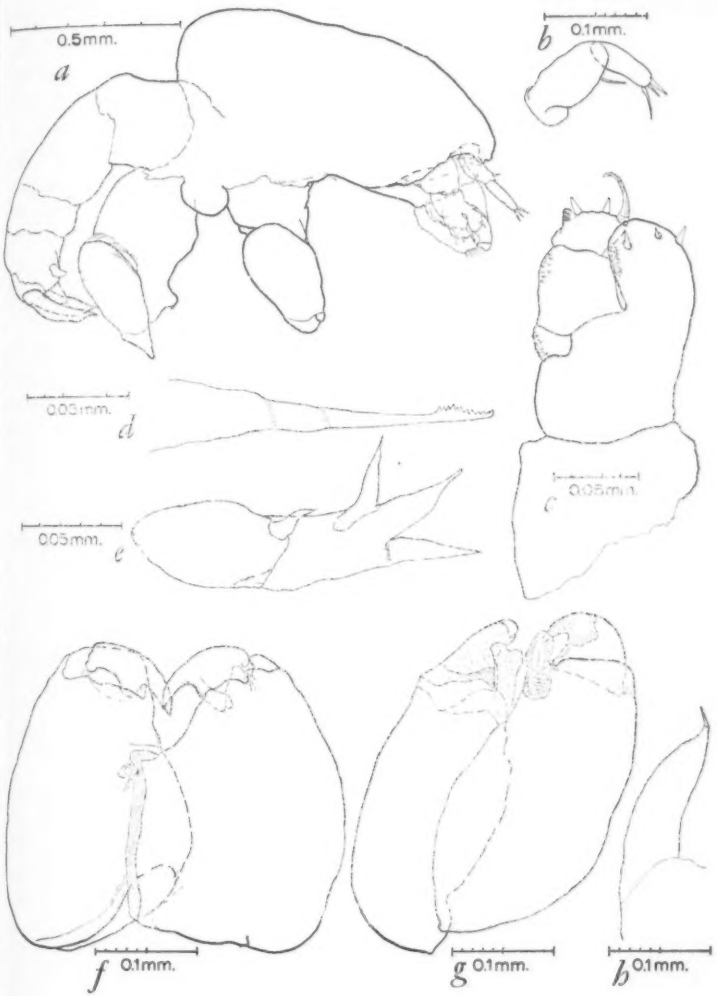

FIGURE 40.—*Paeon vaissierei* Delamare-Deboutteville and Nunes-Ruivo, 1953, male: *a*, lateral view; *b*, left antennule, dorsolateral view; *c*, left antenna, lateral view; *d*, mandible; *e*, maxillule (?), lateral view; *f*, maxilla (?), posterior view; *g*, maxilliped (?), posterior lateral view; *h*, caudal ramus, lateral view.

40*f*) arising from ventral cephalothoracic surface well posterior to mouth cone, both members of appendage pair fused along proximal half of inner surfaces of first segment. Maxilla (?) 2-segmented, first segment well developed, broader proximally than distally; second segment small, fused with heavily sclerotized, clawlike terminal process. Maxilliped (?) (fig. 40*g*) situated posterior to maxilla, 2-segmented. First segment well developed, fused with opposing member of pair along proximal half of inner surface, with heavily sclerotized projection at inner lateral surface that receives tip of heavily sclerotized, clawlike terminal process of second segment when segment flexed. Second segment small, poorly sclerotized except for inner surface, separable from terminal process only by difference in sclerotization.

REMARKS.—A question mark is used, in the designation of the Hawaiian specimens, because of some differences that exist between the original description of *P. vaissierei* and the Hawaiian specimens and because of the inability to definitely assign the specimen from the original description. The primary characteristic used in associating the Hawaiian specimens with *P. vaissierei* is the nature of the lobes of the cephalothorax and, in particular, the posterior median lobe that overhangs the anterior end of the neck. The genital segment is somewhat shorter in the Hawaiian specimens but the annulations in the anterior region and the flaccid nature of the segment suggest that both the shape and size may be variable. The egg strings of the Hawaiian specimens are somewhat longer than those figured by Delamare-Deboutteville and Nunes-Ruivo (1953a) although this characteristic is presumably also variable. It is unfortunate that the single male listed in the specimens of the original collection was not figured and described.

Paeon ferox Wilson (1919), differs from the Hawaiian specimens primarily in the nature of the cephalothorax, *P. ferox* possessing a single, large knob with several sets of protruberances on the anterior ventral surface while the cephalothorax of the Hawaiian specimens has several sets of large lobes. *P. elongatus* Wilson (1932), differs from the Hawaiian specimens not only in the nature of the cephalothorax, which is similar to that of *P. ferox*, but also in the relatively thicker neck, more compact trunk and shorter caudal filaments. *P. versicolor* Wilson (1919) differs from the Hawaiian specimen in having a much shorter, heart-shaped genital segment, a thicker and annulated neck and a broad, laterally ovoid cephalothorax with heavily sclerotized knobs on the anterior surface.

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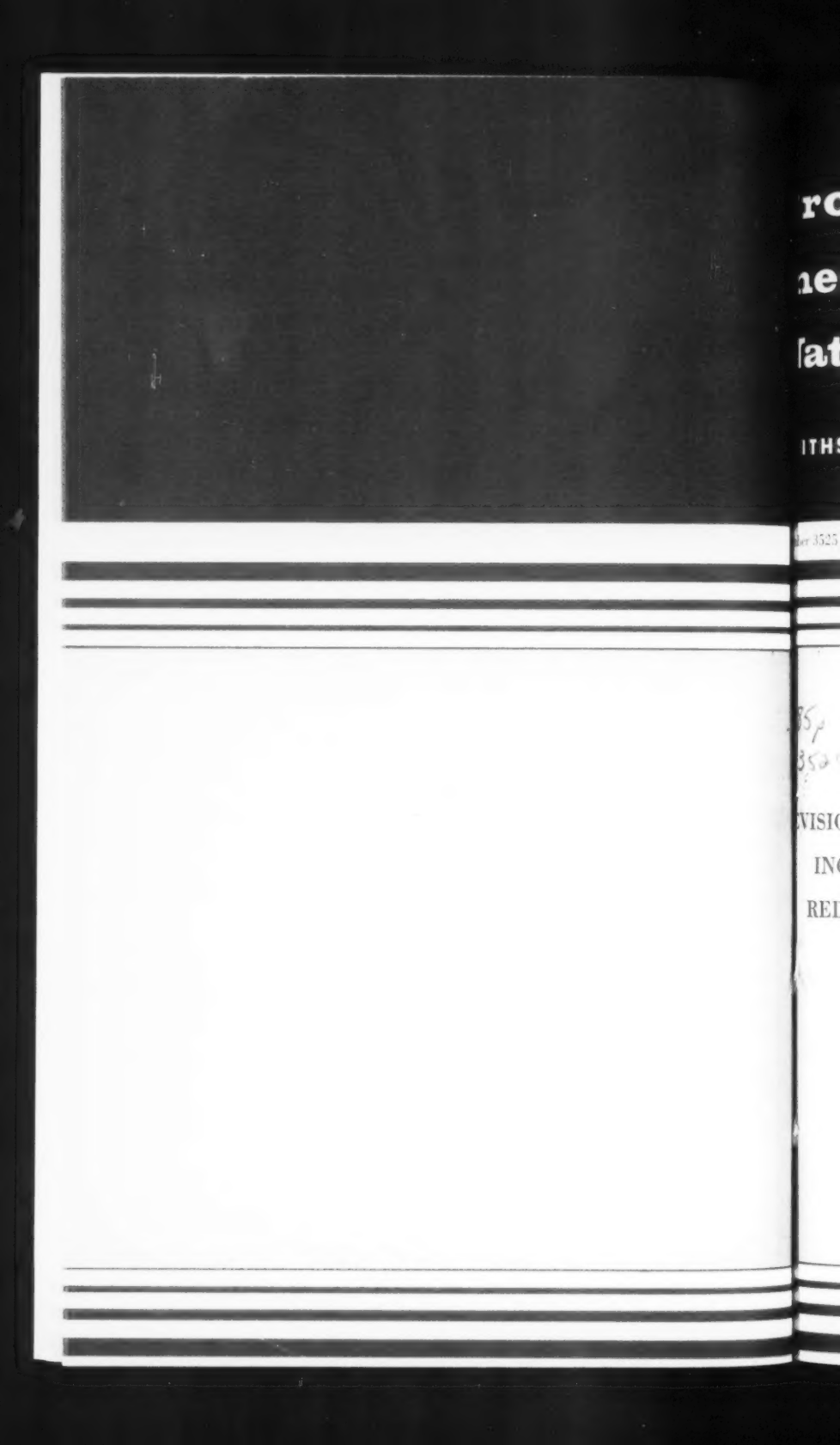

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VISION OF THE PILARGIDAE (ANNELIDA: POLYCHAETA), INCLUDING DESCRIPTIONS OF NEW SPECIES, AND REDESCRIPTION OF THE PELAGIC *PODARMUS PLOA* CHAMBERLIN (POLYNOIDAE)

By MARIAN H. PETTIBONE

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REVISION OF THE PILARGIDAE (ANNELIDA: POLYCHAETA), INCLUDING DESCRIPTIONS OF NEW SPECIES, AND REDESCRIPTION OF THE PELAGIC *PODARMUS PLOA* CHAMBERLIN (POLYNOIDAE)

By MARIAN H. PETTIBONE
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In studying some polychaete material from the Chesapeake Bay, collected by Dr. Marvin Wass of the Virginia Institute of Marine Science, 5 species of pilargids were found, including 3 new species and a species that appeared to be one of the questionable species of Webster, 1879, from Virginia. This prompted a review of the family. The Pilargidae was monographed by Hartman in 1947, including descriptions of 5 species, references to 21 species in all, and keys to the species of *Pilargis*, *Ancistrosyllis*, and *Loandalia*. Seven additional species and 3 genera were listed by Hartman in 1959 and 10 species and 1 genus have been added since 1959, bringing to 38 the number of species included up to the present time in this family. *Ancistrosyllis longicirrata* Berkeley and Berkeley, 1961, was placed by the authors in the Pilargidae but an examination of the holotype, sent on loan through the kindness of Cyril Berkeley, shows that it should be referred to *Podarmus* Chamberlin in the Polynoidae; it is redescribed in this paper.

In addition to the literature, this study is based on collections in the U.S. National Museum and additional material borrowed from the following sources: Allan Hancock Foundation (AHF), through Dr. Olga Hartman, including type material of 5 species; American Museum of Natural History (AMNH), through Dr. Meredith Jones, including type material of 2 species; Mr. Cyril Berkeley, Marine Biological Station, Nanaimo, Canada, including type material of 2 species; Dr. Roland Wigley, Bureau of Commercial Fisheries, Woods Hole, Mass.; Mr. Pierre Brunel, Marine Biological Station, Gaspé, Canada. I wish to express my deep appreciation to those mentioned for their cooperation and loan of material. I am particularly grateful to Dr. Marvin Wass for the opportunity of studying the pilargid material from Virginia, which led into a much more extended study than had been anticipated.

This study was aided in part by a grant from the National Science Foundation (NSF GS–1269).

The genera that have been referred to the Pilargidae have had a checkered history, as shown by table 1, which gives for each genus its original placement in the Polychaeta and its subsequent disposition by various polychaete workers. Not all polychaete authorities have recognized the Pilargidae, referring the species instead to Hesionidae (Ehlers, Chamberlin, Horst, Fauvel, Mesnil, Augener, Southern, Monro, and Treadwell). Omitting the larval *Harpochaeta* and the questionable *Hermundura*, 4 of the 12 remaining genera that have been proposed were indicated to have doubtful family connections and were placed in "genera incertae sedis"; 2 were placed in new families (Otopsidae and Kynephoridae), 3 were considered to be aberrant Syllidae, 1 was placed in the Hesionidae, and 2 in the Pilargidae. This further emphasizes the heterogeneous and enigmatic characters of the family.

The pilargid genera that have been generally recognized are *Pilargis*, *Ancistrosyllis*, and *Loandalia*. As new species have been described, they have for the most part been added to one of these three genera and the groupings of species within the genera have become quite heterogeneous. In this revision, I have attempted to define and limit the genera more clearly, and I have made use of three additional genera which have been either ignored or considered to be questionable: (1) *Sigambra* Müller, 1858, has been considered to be indeterminable, but the figures and description of *S. grubii* seem to be sufficiently detailed to be used. (2) *Cabira* Webster, 1879, a questionable genus based on the confusing description of *C. incerta*, is reinstated, based on recent material collected in Chesapeake Bay. (3) *Synelmis* Chamberlin, 1919, with a single species, *S. simplex*, has been previously overlooked.

TABLE 1.—*List of genera of Pilargidae, indicating their original placement in the Polychaeta and their subsequent disposition*

Genus and type-species by monotypy	Original placement in Polychaeta	Subsequent disposition
Sigambra Müller, 1858 *S. grubii* Brazil	Amytidea Grube? (=Syllidae)	Pilargidae, indeterminable, perhaps same as *Ancistrosyllis*—Hartman, 1947 (footnote), 1959. Retained, see page 179.
Hermundura Müller, 1858 *H. tricuspis* Brazil	Ariciaea (includes Orbiniidae, Spionidae, Magelonidae)	Pilargidae, questionable—Hartman, 1959. Questionable genus and species; same as *Loandalia*? see page 195.
Ancistrosyllis McIntosh, 1879 *A. groenlandica* Greenland	aberrant Syllidae (provisionally)	Syllidae, aberrant—Langerhans, 1881. Hesionidae—Ehlers, 1908; Chamberlin, 1919; Horst, 1921; Fauvel, 1919, 1920, 1923, 1953; Southern, 1921; Monro, 1933a; Treadwell, 1941. Pilargidae—Hessle, 1925; Hartman, 1945, 1947, 1959, 1963; Uschakov, 1955; Hartmann-Schröder, 1959; Kitamori, 1960; Berkeley and Berkeley, 1961; Wesenberg-Lund, 1962; Uschakov and Wu, 1962; Day, 1963; see page 164.
Phronia Webster, 1879 *P. tardigrada* Virginia	incertae sedis	Pilargidae, preoccupied in Diptera, = *Pilargis*—Saint-Joseph, 1899. Indeterminable to species, see page 161.
Cabira Webster, 1879 *C. incerta* Virginia	incertae sedis	Hesionidae, = *Ancistrosyllis*—Fauvel, 1920. Pilargidae, questionable—Hartman, 1947, 1959. Revised, see page 177.
Harpochaeta Korschelt, 1893 *H. cingulata* Mediterranean, in plankton	larval Polychaeta (Syllidae? Hesionidae?)	Hesionidae, = *Ancistrosyllis*—Ehlers, 1908; Fauvel, 1920, 1923. Pilargidae, = *Ancistrosyllis*—Hartman, 1947, 1959. Larval pilargid, genus? see page 195.

TABLE 1.—Continued

Genus and type-species by monotypy	Original placement in Polychaeta	Subsequent disposition
Pilargis Saint-Joseph, 1899 *P. verrucosa* France	Pilargidae, new family	Hesionidae—Fauvel, 1920, 1923; Horst, 1921; Berkeley and Berkeley, 1948. Pilargidae—Hessle, 1925; Hartman, 1947, 1959; Uschakov, 1955; see page 160.
Otopsis Ditlevsen, 1917 *O. longipes* South of Iceland	Otopsidae, new family	Pilargidae—Hartman, 1947 (footnote), 1959; Uschakov, 1955; see page 164.
Synelmis Chamberlin, 1919 *S. simplex* South Pacific	Syllidae	Pilargidae, = *Ancistrosyllis*, perhaps *A. rigida* Fauvel—Hartman, 1959. Retained, see page 190.
Kynephorus Ehlers, 1920 *K. inermis* South Pacific	Kynephoridae, new family	Hesionidae, = *Ancistrosyllis*—Augener, 1927; Fauvel, 1953. Pilargidae, = *Ancistrosyllis*—Hartman, 1947. = *Synelmis*, see page 190.
Telehsapia Fauvel, 1932 *T. annandalei* Gulf of Siam	incertae sedis (very aberrant euniceid?)	Pilargidae—Hartman, 1947. Hesionidae—Fauvel, 1953. Pilargidae, questionable; same as *Loandalia*? see page 195.
Loandalia Monro, 1936 *L. aberrans* South West Africa	incertae sedis (aberrant hesionid?)	Hesionidae—Mesnil and Fauvel, 1939; Berkeley and Berkeley, 1941. Pilargidae—Hartman, 1947, 1959; Hartmann-Schröeder, 1959; Day, 1963; see page 195.
Glyphohesione Friedrich, 1950 *G. klatti* Europe	Hesionidae	Pilargidae, = *Ancistrosyllis*—Hartman, 1959; Eliason, 1962. = *Synelmis*, see page 190.
Ancistargis Jones, 1961 *A. papillosus* Gulf of Mexico	Pilargidae	Pilargidae, = *Ancistrosyllis*, see page 164.

Based on this revision, many pilargid species are recombined and some species put into synonymy. Seven genera of Pilargidae are herein retained: *Ancistrosyllis* (9 species), *Sigambra* (9 species), *Pilargis* (4 species), *Cabira* (4 species), *Loandalia* (2 species), *Synelmis* (2 species), *Otopsis* (2 species). I have not included *Telehsapia* Fauvel, with the questionable *T. annandalei*, or *Hermundura* Müller, with the questionable *H. tricuspis*, except to place them both questionably under *Loandalia* Monro. *Phronia* Webster, preoccupied, is referred to *Pilargis*. *Kynephorus* Ehlers and *Glyphohesione* Friedrich are referred to *Synelmis*. *Ancistargis* Jones is referred to *Ancistrosyllis*. *Harpochaeta* Korschelt is based on the larval form *H. cingulata*. For each genus, a synonymy, diagnosis, list of species, and key to the species are given. Where material was available for study, descriptions and figures of some of the species are included.

Descriptions are given for the following species (the 5 species of pilargids from Chesapeake Bay are noted by asterisks):

PILARGIDAE

Ancistrosyllis breviceps Hartman
Ancistrosyllis groenlandica McIntosh
Ancistrosyllis hamata (Hartman), new combination
**Ancistrosyllis hartmanae*, new species
**Ancistrosyllis jonesi*, new species
Ancistrosyllis papillosa (Jones), new combination
**Cabira incerta* Webster, revised
Loandalia fauveli Berkeley and Berkeley
Pilargis berkeleyae Monro
Sigambra bassi (Hartman), new combination
Sigambra grubii Müller
**Sigambra tentaculata* (Treadwell), new combination
**Sigambra wassi*, new species
Synelmis albini (Langerhans), new combination

POLYNOIDAE

Podarmus ploa Chamberlin

Family Pilargidae Saint-Joseph, 1899

Body vermiform, cylindrical, somewhat depressed, or flattened, ribbon-like. Integument smooth or papillated. Prostomium, tentacular segment, and first setigerous segment more or less fused. Prostomium usually small, inconspicuous, usually with antennae (3 to 0); median antenna, when present, on posterior part of prostomium; with pair of biarticulate palps consisting of large palpophores more or less set off from prostomium and small palpostyles (filiform, button-like or absent); eyes usually absent. Tentacular segment achaetous, apodous, with usually 2 pairs of tentacular cirri (rarely one pair or none). Dorsal cirri of first setigerous segment often longer than following.

Parapodia subbiramous. Notopodia reduced to embedded notoacicula in cirrophores of dorsal cirri, with or without additional capillary setae or stout emergent acicular setae which may be straight or hooked. Neuropodia cylindro-conical, with embedded neuroacicula and simple neurosetae (no compound setae, as in Hesionidae). Dorsal and ventral cirri usually present. Pygidium usually with pair of anal cirri. Proboscis unarmed, bulbous or long cylindrical, usually with circlet of papillae around opening. Intestine usually with intestinal caeca (at least in forms with well-developed parapodia). Burrowing forms.

Key to the Genera of Pilargidae

1. With internal notoacicula only or with additional fine capillary notosetae . 2
   With stout emergent dorsal setae in addition to internal notoacicula . . . 4
2. Without antennae, tentacular cirri, dorsal or ventral cirri (small cirri may be present at terminal parts of neuropodial lobes but not in usual position). Notopodia with projecting stout notoacicula and few slender notosetae. Body subcylindrical . . . . . **Loandalia** Monro, p. 195
   With antennae, tentacular cirri, dorsal and ventral cirri. Notopodia with internal notoacicula only. Body flattened, ribbon-like 3
3. Two small lateral antennae, without median antenna. Palps biarticulate, with small palpostyles. Ventral cirri short, conical. Integument minutely papillated . . . . . **Pilargis** Saint-Joseph, p. 160
   Three small antennae, median and lateral. Palps indistinct, without palpostyles. Ventral cirri lamelliform. Integument smooth, not papillated . . . . . **Otopsis** Ditlevsen, p. 164
4. Stout emergent dorsal setae straight, not hooked. Body subcylindrical, with parapodia sharply marked off from body. Neurosetae capillary, limbate. Integument smooth, not papillated. . . . . **Synelmis** Chamberlin, p. 190
   Stout emergent dorsal setae hooked 5
5. Body subcylindrical, with parapodia poorly developed. Dorsal and ventral cirri small or lacking . . . . . **Cabira** Webster, p. 177
   Body elongate, depressed, with parapodia deeply cut. Dorsal and ventral cirri distinct 6
6. Prostomium small, inconspicuous, with antennae shorter than palps. Tentacular cirri short. Dorsal cirri of first setiger similar to or slightly longer than following. Dorsal cirri short. Neurosetae longer to shorter, with tips slightly bent, smooth, and spinous. Integument papillated. **Ancistrosyllis** McIntosh, p. 164
   Prostomium larger, with antennae longer than palps. Tentacular cirri long. Dorsal cirri of first setiger unusually long. Dorsal cirri long and slender. Neurosetae with capillary tips. Integument smooth. **Sigambra** Müller, p. 179

Genus *Pilargis* Saint-Joseph, 1899

Pilargis Saint-Joseph, 1899. [Type-species: *P. verrucosa* Saint-Joseph, 1899, by monotypy. Gender: feminine.]

Phronia Webster, 1879. [Type-species: *P. tardigrada* Webster, 1879, by monotypy. Gender: feminine. Preoccupied by Winnerz, 1863, in Diptera.]

Diagnosis: Body long, flattened, ribbon-like, with parapodia deeply cut. Prostomium reduced, biarticulate palps with large ovoid palpo-

phores and small papillar palpostyles, paired short lateral antennae, without median antenna. Tentacular segment with 2 pairs of tentacular cirri. Parapodia subbiramous. Notopodia with inflated cirrophores with internal notoacicula, without notosetae; conical dorsal cirri more or less set off from dorsal cirrophores. Neuropodia conical lobes with stout neuroacicula; neurosetae simple, variable in length; ventral cirri short, conical. Pygidium with or without short anal cirri. Proboscis unarmed, globular. Integument minutely papillated.

The following species have been referred to *Pilargis:*

P. tardigrada (Webster, 1879, p. 258), as *Phronia tardigrada.* Virginia. See Fauvel, 1920, p. 212. Questionable species. Type-specimen not available.

P. verrucosa Saint-Joseph, 1899, p. 175. France. See Fauvel, 1920, p. 212; 1923, p. 252.

P. perezii Charrier, 1924, p. 11. France. Referred to *P. verrucosa,* Fauvel, 1925, p. 88.

P. pacifica (Zachs, 1933, p. 128), as *P. verrucosa pacifica.* North Japan Sea. See Uschakov, 1955, p. 201.

P. berkeleyae Monro, 1933b, p. 673, as *P. berkeleyi* (named after Edith Berkeley). Washington, North Pacific. See page 161.

P. maculata Hartman, 1947, p. 494. Central California. Referred to *P. berkeleyae,* see page 161.

P. falcata Day, 1957, p. 70. South Africa. Referred to *Ancistrosyllis,* see page 165.

P. matsunagaensis Kitamori, 1960, p. 1088. Seto-Inland Sea, Japan. Referred to *Ancistrosyllis,* see page 165.

P. hamatus Hartman, 1960, p. 88. Southern California. Referred to *Ancistrosyllis,* see page 165.

Key to the Species of *Pilargis*

1. Neurosetae uniformly simple, capillary 2
   Some neurosetae with slightly hooked tips 3
2. Tentacular cirri subequal . . . . . **P. pacifica** (Zachs)
   Upper pair of tentacular cirri much longer than lower pair. **P. tardigrada** (Webster)
3. Neurosetae smooth . . . . . **P. verrucosa** Saint-Joseph
   Shorter neurosetae with spinous blades . . . . . **P. berkeleyae** Monro

Pilargis berkeleyae Monro

FIGURES 1, 2

Pilargis berkeleyi [sic] Monro, 1933b, p. 673, figs. 1–4.—Berkeley and Berkeley, 1935, p. 768; 1948, p. 57, figs. 85, 86.—Hartman, 1947, p. 491, pl. 59, figs. 1–8; 1963, p. 16.

Pilargis maculata Hartman, 1947, p. 494, pl. 60, figs, 1–5; 1963, p. 16.

Material examined: Elkhorn Slough, Monterey Bay, Calif., loan from Cyril Berkeley. Paratype of *P. maculata* Hartman, Moss Beach, Calif., AHF 1716, loan from Olga Hartman (long specimen without anterior end).

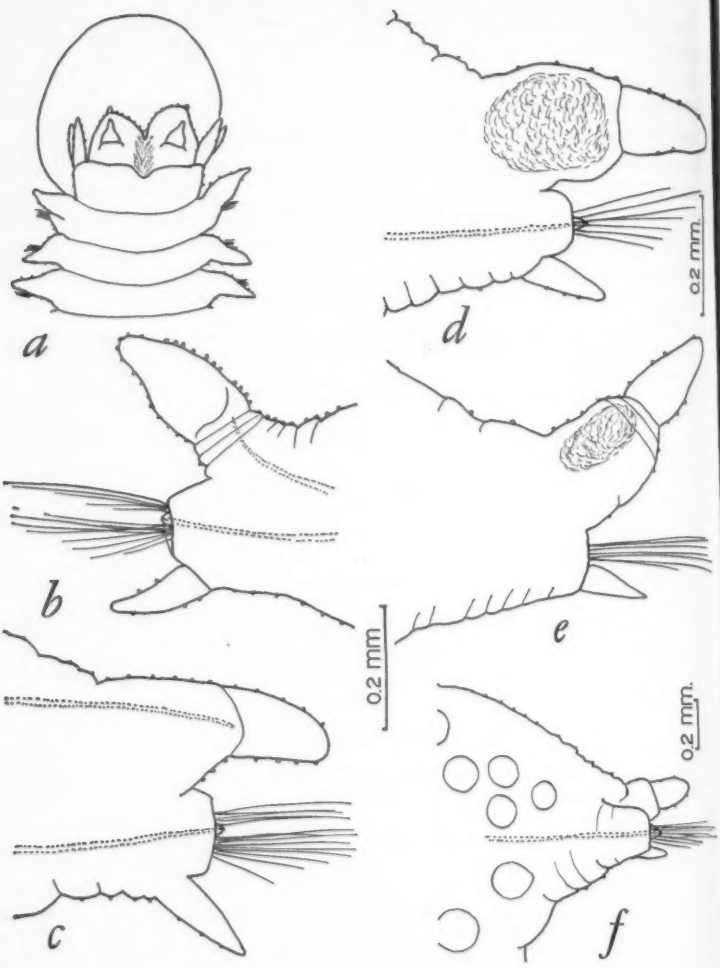

FIGURE 1.—*Pilargis berkeleyae* Monro (*a–e* from complete specimen from Monterey Bay; *f*, from smaller incomplete specimen from same locality): *a*, dorsal view anterior end, with proboscis extended; *b*, parapodium from setiger 18; *c*, same, from setiger 75; *d*, same, from middle of body (about setiger 200), pigmented glandular area in dorsal cirrophore shown; *e*, same, from posterior part of body (about setiger 400); *f*, same, from middle of body, with some large yolky eggs visible.

Description: Length to 300 mm., width to 4 mm., segments to 500. Body flattened, ribbon-like, tapered anteriorly and posteriorly. Integument with low papillae on body and appendages, more numerous dorsally. Prostomium small, inconspicuous, with ovate palpophores indistinct from prostomium and minute palpostyles, with paired short lateral antennae. Tentacular segment fused with prostomium, with two pairs of short tentacular cirri, dorsal pair slightly longer than ventral pair. Dorsal cirri of first setigerous

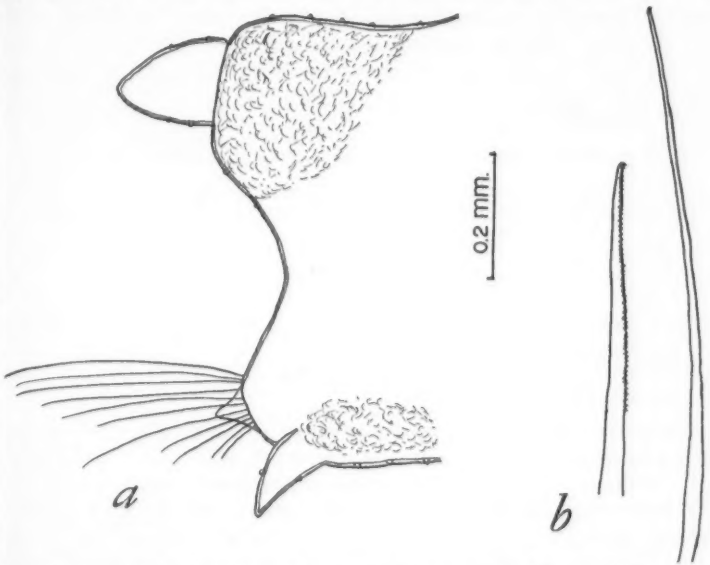

FIGURE 2.—*Pilargis berkeleyae* Monro (from paratype of *P. maculata* Hartman, AHF 1716): *a*, parapodium from middle of body of inflated specimen, with pigmented glandular areas shown; *b*, neurosetae from same.

segment longer than following. Inflated dorsal cirrophores of notopodia variable in shape, as indicated in figures drawn from different parts of body and individuals in different states of contraction; notoacicula colorless, without notosetae; dorsal cirri conical to ovate. Neuropodia conical, with stout neuroacicula and bundle of simple neurosetae; neurosetae variable in length; shorter neurosetae serrate, with tips slightly hooked, sometimes faintly bifid; longest neurosetae tapering to fine slightly hooked tips, smooth or very faintly serrated; ventral cirri on all setigerous segments. Pygidium rounded, with 0, 2 or 3 anal cirri. Proboscis thin-walled translucent sac. Reddish to dark-brown glandular areas in notopodial cirrophores and ventral bases of neuropodia.

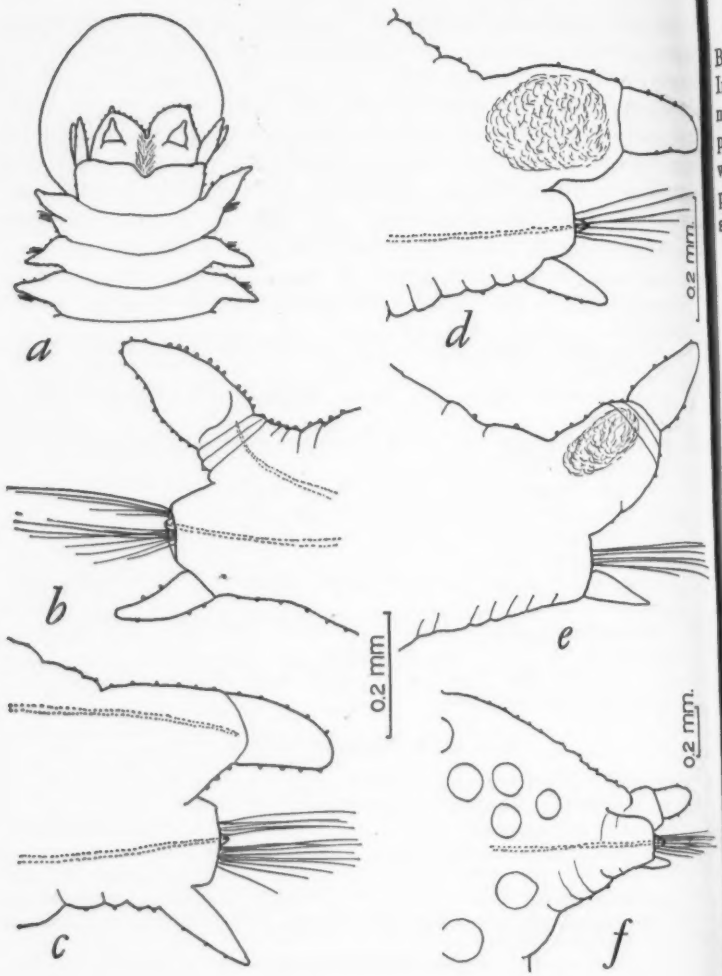

FIGURE 1.—*Pilargis berkeleyae* Monro (*a–e* from complete specimen from Monterey Bay; *f*, from smaller incomplete specimen from same locality): *a*, dorsal view anterior end, with proboscis extended; *b*, parapodium from setiger 18; *c*, same, from setiger 75; *d*, same, from middle of body (about setiger 200), pigmented glandular area in dorsal cirrophore shown; *e*, same, from posterior part of body (about setiger 400); *f*, same, from middle of body, with some large yolky eggs visible.

Description: Length to 300 mm., width to 4 mm., segments to 500. Body flattened, ribbon-like, tapered anteriorly and posteriorly. Integument with low papillae on body and appendages, more numerous dorsally. Prostomium small, inconspicuous, with ovate palpophores indistinct from prostomium and minute palpostyles, with paired short lateral antennae. Tentacular segment fused with prostomium, with two pairs of short tentacular cirri, dorsal pair slightly longer than ventral pair. Dorsal cirri of first setigerous

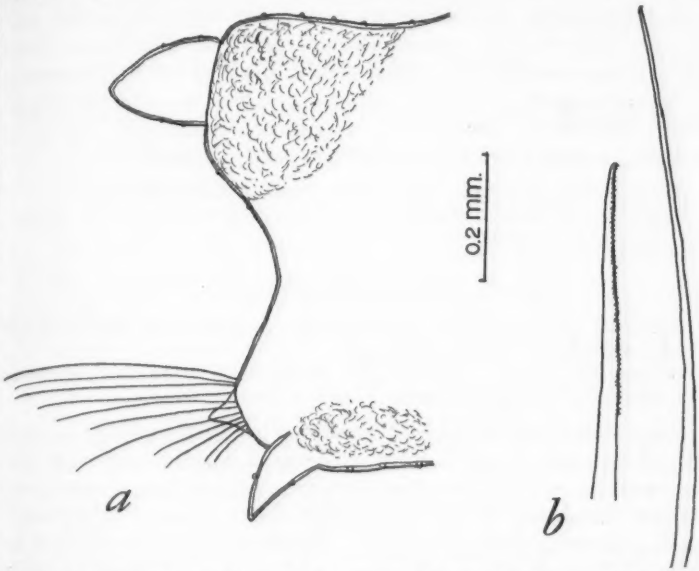

FIGURE 2.—*Pilargis berkeleyae* Monro (from paratype of *P. maculata* Hartman, AHF 1716): *a*, parapodium from middle of body of inflated specimen, with pigmented glandular areas shown; *b*, neurosetae from same.

segment longer than following. Inflated dorsal cirrophores of notopodia variable in shape, as indicated in figures drawn from different parts of body and individuals in different states of contraction; notoacicula colorless, without notosetae; dorsal cirri conical to ovate. Neuropodia conical, with stout neuroacicula and bundle of simple neurosetae; neurosetae variable in length; shorter neurosetae serrate, with tips slightly hooked, sometimes faintly bifid; longest neurosetae tapering to fine slightly hooked tips, smooth or very faintly serrated; ventral cirri on all setigerous segments. Pygidium rounded, with 0, 2 or 3 anal cirri. Proboscis thin-walled translucent sac. Reddish to dark-brown glandular areas in notopodial cirrophores and ventral bases of neuropodia.

Distribution: Washington to southern California. Intertidal to 225 fms.

Genus *Otopsis* Ditlevsen, 1917

Otopsis Ditlevsen, 1917. [Type-species: *O. longipes* Ditlevsen, 1917, by monotypy. Gender: masculine.]

Diagnosis: Body long, flattened, with lateral parapodia deeply cut. Prostomium small, with 3 small antennae, 2 palps (without palpostyles). Tentacular segment achaetous, with 2 pairs tentacular cirri. Parapodia subbiramous. Notopodia with embedded notoacicula only, without notosetae or emergent acicular setae. Dorsal cirri large, lamelliform. Neuropodia conical, with neuroacicula and simple capillary neurosetae. Ventral cirri lamelliform. Pygidium? Proboscis? Integument smooth, not papillated.

A single species and subspecies have been described:

Otopsis longipes Ditlevsen, 1917, p. 67. South of Iceland, 843 fms.
Otopsis longipes pacificus Uschakov, 1950, p. 171, as *O. longipes* var. *pacifica*. Okhotsk Sea, 709–757 fms.

Genus *Ancistrosyllis* McIntosh, 1879

Ancistrosyllis McIntosh, 1879. [Type-species: *A. groenlandica* McIntosh, 1879, by monotypy. Gender: feminine.]
Ancistargis Jones, 1961. [Type-species: *A. papillosus* Jones, 1961, by original designation. Gender: feminine.]

Diagnosis: Body elongate, depressed, with lateral parapodia deeply cut. Prostomium small, inconspicuous; 2 biarticulate palps with large palpophores and small palpostyles; antennae short, usually 3 in number, consisting of lateral antennae (rarely absent) and posterior median antenna (may be absent). Tentacular segment more or less fused with prostomium, achaetous, with 2 pairs of short tentacular cirri (rarely only 1 pair?). Dorsal and ventral cirri short. Parapodia subbiramous. Notopodia inflated, with notoacicula curved distally, with stout emergent hooked setae beginning on setigers 3–13. Neuropodia with conical to truncate setigerous lobes, with neuroacicula and simple neurosetae. Neurosetae variable in length, smooth, finely to coarsely spinous, usually ending in slightly hooked tips (tips may be indistinctly bidentate). Pygidium with paired short anal cirri. Proboscis unarmed, cylindrical, globular, with or without papillae. With intestinal caeca. Integument with scattered papillae.

Remarks: The chief distinction between *Ancistargis* and *Ancistrosyllis* is the absence of a median antenna in the former and its presence in the latter. The median antenna, when present, is small to minute and often difficult to detect. Located as it is on the posterior part of the prostomium, it may be hidden when the prostomium is retracted partially within the tentacular segment. Of the species listed below,

four lack a median antenna: *A. falcata*, *A. matsunagaensis*, *A. hamata*, and *A. papillosa*. One species, *A. quellina*, lacks lateral antennae.

The following species have been referred to *Ancistrosyllis:*

A. groenlandica McIntosh, 1879, p. 502. Davis Strait, Greenland. See page 166.

A. albini Langerhans, 1881, p. 107. Canary Islands, North Atlantic. Referred to *Synelmis*, see page 191.

A. robusta Ehlers, 1908, p. 59. South Atlantic. Referred to *Sigambra*, see page 181.

A. rigida Fauvel, 1919, p. 337. Red Sea. Referred to *Synelmis albini*, see page 191.

A. constricta Southern, 1921, p. 573. India. Referred to *Sigambra*, see page 181.

A. gracilis Hessle, 1925, p. 34. Off Japan. Referred to *Synelmis albini*, see page 191.

A. gorgonensis Monro, 1933a, p. 26. Pacific side of Panama. Referred to *Synelmis albini*, see page 191.

A. tentaculata Treadwell, 1941, p. 1. Long Island, N.Y. Referred to *Sigambra*, see page 182.

A. bassi Hartman, 1945, p. 15. Florida and North Carolina. Referred to *Sigambra*, see page 186.

A. ocellata Hartmann-Schröder, 1959, p. 109. Central America. Referred to *Sigambra*, see page 181.

A. hanaokai Kitamori, 1960, p. 1086. Seto-Inland Sea. Referred to *Sigambra*, see page 181.

A. longicirrata Berkeley and Berkeley, 1961, p. 658. Off Peru, in plankton. Synonym of *Podarmus ploa*, Polynoidae, see page 200.

A. quellina Wesenberg-Lund, 1962, p. 68. Chile.

A. pilargiformis Uschakov and Wu, 1962, p. 75. Yellow Sea. Referred to *Cabira*, see page 177.

A. parva Day, 1963, p. 395. South Africa. Referred to *Sigambra*, see page 181.

A. breviceps Hartman, 1963, p. 13. Southern California, see page 168.

The following species are herein referred to *Ancistrosyllis:*

A. falcata (Day, 1957, p. 70), as *Pilargis falçata*. South Africa.

A. matsunagaensis (Kitamori, 1960, p. 1088), as *Pilargis matsunagaensis*. Seto-Inland Sea, Japan.

A. hamata (Hartman, 1960, p. 88), as *Pilargis hamatus*. Southern California. See page 168.

A. papillosa (Jones, 1961, p. 3), as *Ancistargis papillosus*. Florida. See page 170.

A. hartmanae, new species. Chesapeake Bay. See page 172.

A. jonesi, new species. Chesapeake Bay. See page 173.

Key to the Species of *Ancistrosyllis*

1. Ventral cirri beginning on setiger 1. With lateral antennae. Tentacular cirri 2 pairs. With notoacicula 2
   Ventral cirri beginning on setiger 3–4 5

2. Notopodial hooked setae beginning on setiger 3–6. Dorsal cirri of first setiger longer than following 3
Notopodial hooked setae beginning on setiger 7–13 4
3. Short median antenna. Notopodial hooked setae beginning on setiger 4–6. **A. groenlandica**, p. 166
Without median antenna. Notopodial hooked setae beginning on setiger 3. **A. matsunagaensis**.
4. Notopodial hooked setae beginning on setiger 7. Without median antenna. With paired deep-set minute eyes. Dorsal cirri small, ovoid. Ventral cirri small, near tips of parapodial lobes . . . . . **A. falcata**
Notopodial hooked setae beginning on setiger 13 (not emergent at first). With short median antenna (sometimes difficult to detect). Without eyes. Dorsal cirri short, subulate. Ventral cirri larger, at base of neuropodial lobes . . . . . **A. breviceps**, p. 168
5. Ventral cirri beginning on setiger 4. Notopodial hooked setae beginning on setiger 4. Tentacular cirri 1 pair. Without lateral antennae. Without notoacicula. Eyespots 2 pairs . . . . . **A. quellina**
Ventral cirri beginning on setiger 3. Tentacular cirri 2 pairs. With lateral antennae. With notoacicula 6
6. Notopodial hooked setae beginning on setiger 3. Eyes 1 pair 7
Notopodial hooked setae beginning on setiger 6. Without eyes 8
7. Without median antenna. Lateral antennae extending beyond palps. Anterior part of digestive tract not looped . . . . . **A. papillosa**, p. 170
Short median antenna, which may be partially hidden by tentacular segment. Lateral antennae shorter than palps. Anterior part of digestive tract looped . . . . . A. hartmanae, p. 172
8. Without median antenna. Notopodial acicular lobe low, thick, not elongated, with short conical dorsal cirri . . . . . **A. hamata**, p. 168
Small median antenna (easily overlooked). Notopodial acicular lobe enlarged, conical, extending nearly to tip of neuropodial lobe, with small dorsal cirri indistinctly separated from notopodial lobe . . **A. jonesi**, p. 173

Ancistrosyllis groenlandica McIntosh

FIGURE 3

Ancistrosyllis groenlandica McIntosh, 1879, p. 502, pl. 65, figs. 3, 20.—Pettibone, 1963, p. 110, fig. 30.—Hartman, 1965, p. 71.

Material examined: North Atlantic, *Albatross* III, 42°10′ N., 69°18′ W., 100 fms., 1955, R. Wigley; *Delaware* sta., 42°31′ N., 67°48′ W., 175 fms., 1959, R. Wigley. Gulf of St. Lawrence, P. Brunel.

Description: Length to 40 mm., width to 1 mm., segments to 70. Body flattened dorsoventrally, widest in middle region, tapering anteriorly and posteriorly, with parapodia deeply cut. Prostomium with large palpophores and small button-like palpostyles (easily overlooked); 3 small subequal antennae shorter than palps; without eyes. Tentacular segment indistinct from prostomium, with 2 pairs of short subequal tentacular cirri, similar to antennae; irregular lateral pigmented areas may be present (fig. 3*a*; these are probably the large lateral eyes mentioned and figured by McIntosh). Dorsal cirri of

first setiger about twice as long as following. Dorsal cirri fusiform, short, extending slightly beyond neuropodial lobes. Notopodia with somewhat inflated notoacicular lobes and emergent hooked setae

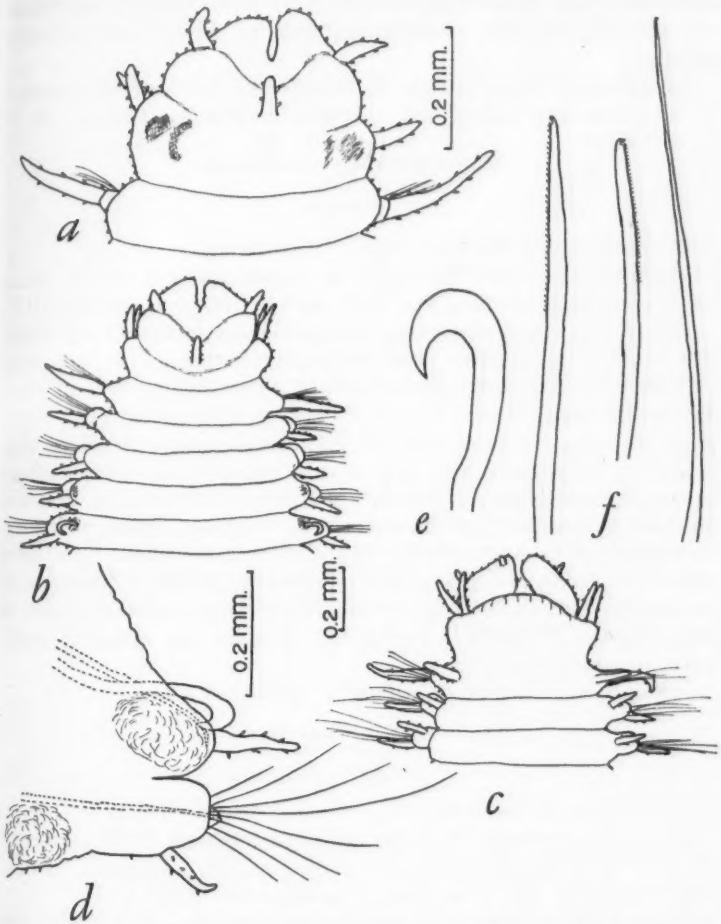

FIGURE 3.—*Ancistrosyllis groenlandica* (*a*, from specimen from *Delaware* sta.; *b–f* from specimen from *Albatross* sta.): *a*, dorsal view anterior end; *b*, same, from another specimen; *c*, ventral view anterior end; *d*, middle parapodium; *e*, notopodial hooked seta; *f*, neurosetae.

beginning on setiger 4 to 6. Neuropodial lobe conical, with neuroaciculum and neurosetae variable in length; shorter ones wider, tapering to slightly hooked tips, faintly spinous; longer ones more slender, smooth or very finely spinous, with fine slightly hooked tips.

Pygidium rounded, with paired short anal cirri similar to dorsal cirri. Proboscis short, cylindrical, with few scattered papillae. With conspicuous rust-colored glandular areas in anterior part of notopodial lobe (beginning on setiger 4) and ventrally near bases of parapodia (fig. 3*d*). Integument with numerous scattered short papillae.

Distribution: West Greenland, British Isles, Gulf of St. Lawrence to off-shore New Jersey, off northeastern South America. In 25 to 1611 fms.

Ancistrosyllis breviceps Hartman

FIGURE 4

Ancistrosyllis breviceps Hartman, 1963, p. 13, fig. 1, a–d.

Material examined: Holotype of *Ancistrosyllis breviceps*, Santa Monica Canyon, 386 fms., Sta. 7517, loan from Olga Hartman (AHF).

Description: Body depressed, parapodia longer than body width. Prostomium small, with large palpophores and small palpostyles (visible ventrally); antennae very short, not extending beyond palps. Tentacular segment with 2 pairs of subequal tentacular cirri, longer than antennae. Dorsal cirri of first setiger slightly longer than following. Notopodia low, with slender notoacicula and prominent emergent hooked setae beginning about setiger 13 (possibly irregular, not emergent at first); dorsal cirri short, subulate. Neuropodia long, subconical, with neuroacicula and simple neurosetae. Neurosetae variable in length, with tips slightly hooked (according to Hartman, all neurosetae taper to fine tips). Ventral cirri short, subulate, begin on first setiger. Proboscis? Pygidium? Integument minutely papillated, especially dorsally.

Distribution: Southern California. In 191–533 fms.

Ancistrosyllis hamata (Hartman)

FIGURE 5

Pilargis hamatus [sic] Hartman, 1960, p. 88, pl. 7, figs. 4–6; 1963, p. 16.

Material examined: Paratype (anterior fragment of 60 segments) from off Long Beach breakwater light, southern California, 12 fms., sandy mud, Sta. 2311, loan from Olga Hartman (AHF).

Description: Length to 30 mm., width to 2 mm., segments to 100. Body flattened dorsoventrally, widest in middle region, tapering anteriorly and posteriorly, with parapodia deeply cut. Prostomium with large palpophores and small palpostyles, with low conical lateral antennae, much shorter than palps. Tentacular segment indistinct from prostomium, with 2 pairs of short subequal tentacular cirri. Dorsal cirri of first setiger slightly longer than following. Notopodia

with low inflated notoacicular lobes, with very small conical dorsal cirri, much shorter than neuropodial lobes, with prominent stout emergent hooks beginning on setiger 6 (4–7, according to Hartman). Neuropodial lobes short, truncate, with retractile conical neuroacicular lobes, with bundle of about 7 simple neurosetae. Neurosetae variable

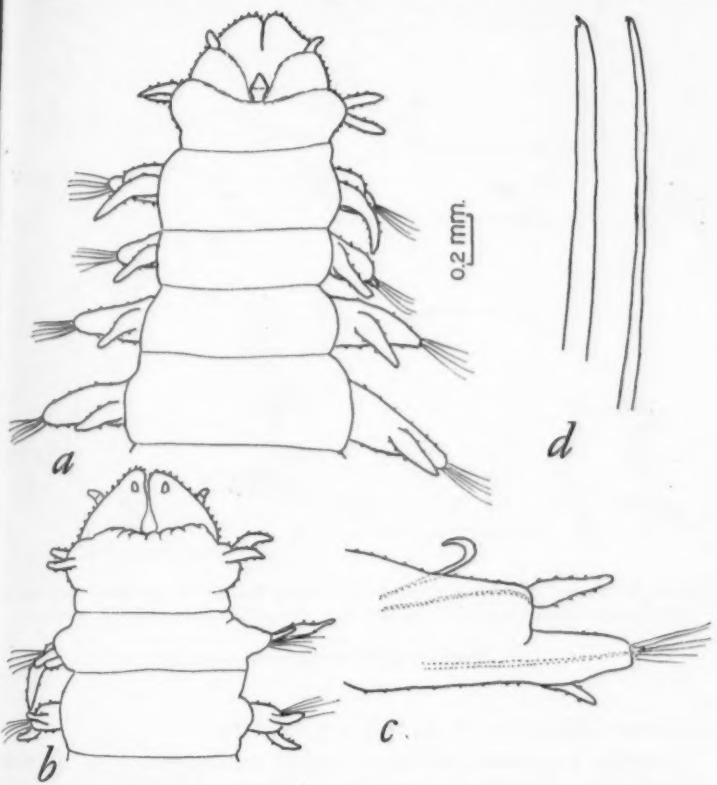

FIGURE 4.—*Ancistrosyllis breviceps* (from holotype): *a*, dorsal view anterior end; *b*, ventral view anterior end; *c*, middle parapodium; *d*, neurosetae.

in length, faintly serrated, with tips slightly hooked, tips may be faintly bifid (according to Hartman, neurosetae of 2 kinds, slender, capillary and stouter, with bifid tips). Ventral cirri small, conical, beginning on setiger 3. Pygidium? Proboscis? With intestinal caeca. Integument with rather thick cuticle, with scattered minute papillae.

Distribution: Southern California. In 12 to 721 fms.

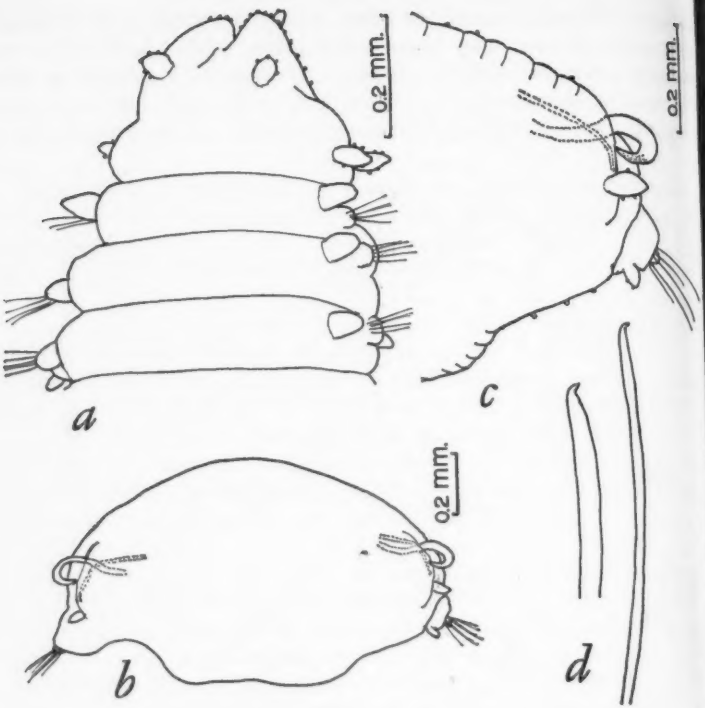

FIGURE 5.—*Ancistrosyllis hamata* (from paratype from Sta. 2311): *a*, dorsal view anterior end; *b*, cross section in region of setiger 60; *c*, parapodium from same; *d*, neurosetae.

Ancistrosyllis papillosa (Jones)

FIGURE 6

Ancistargis papillosus [sic] Jones, 1961, p. 3, figs. 1–14.

Material examined: Holotype and 2 paratypes from Alligator Harbor, Fla., loan from Meredith L. Jones (AMNH). One small specimen, Port Aransas, Tex., 5 fms., mud, M. L. Jones (AMNH).

Description: Length to 10 mm., width to 0.5 mm., segments to 54. Body flattened dorsoventrally, widest in middle region, tapering anteriorly and posteriorly, with segmental dorsal transverse ridges, parapodia deeply cut. Prostomium with large palpophores and small filiform palpostyles, with short digitiform lateral antennae extending slightly beyond palps, with paired small eyespots ventrally. Tentacular segment indistinct from prostomium, with 2 pairs of tentacular cirri, longer than palps. Dorsal cirri of first setiger similar to following. Dorsal cirri fusiform, short, extending slightly beyond neuro-

podial lobes. Notopodia with somewhat inflated notoacicular lobes and emergent hooked setae beginning on setiger 3. Neuropodia conical, with neurosetae of 3 kinds: long, slender, capillary; shorter,

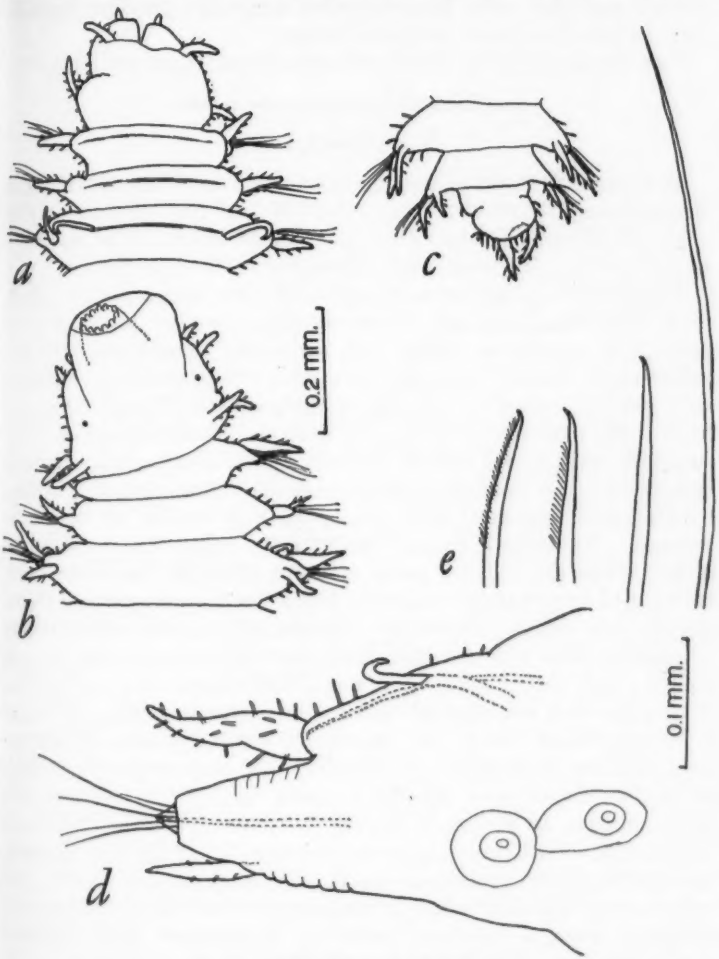

FIGURE 6.—*Ancistrosyllis papillosa* (from paratypes): *a*, dorsal view anterior end; *b*, ventral view anterior end, with proboscis partially extended; *c*, ventral view posterior end; *d*, middle parapodium, with two large yolky developing eggs shown; *e*, neurosetae.

faintly serrated, with slightly hooked tips; shortest, spinous, with hooked tips. Ventral cirri short, fusiform, shorter than dorsal cirri, beginning on setiger 3. Pygidium rounded, with pair short anal

cirri, similar to dorsal cirri. Proboscis cylindrical, with muscular core and thin transparent covering, with short papillae around opening. With intestinal caeca. Integument with numerous papillae on dorsal surface and cirri, with fewer papillae ventrally; papillae especially long on dorsal cirri and notopodial lobes.

Distribution: Gulf of Mexico (Florida, Texas). Intertidal to 5 fms.

***Ancistrosyllis hartmanae* new species**

FIGURES 7, 8

The species is based on a single specimen from Chesapeake Bay off Rappahanock River, 37°32′ N., 76°07′ W. in 7 fms. in mud, July 21, 1961, M. Wass, collector, holotype USNM 30989. The species is named for Olga Hartman, eminent worker on the polychaetes.

Description: Length 25 mm., width 0.5 mm., segments 110. Body long, threadlike, flattened dorsoventrally, tapering anteriorly and posteriorly, parapodia deeply cut, appearing moniliform. Prostomium small, bilobed, partially retractable within tentacular segment, with paired biarticulate palps indistinctly set off from rest of prostomium, with palpophores large, papillated and small palpostyles visible ventrally, with pair of lateral antennae shorter than palps, with small unpaired median antenna posteriorly on prostomium, partially hidden by tentacular segment, with 2 deep-set eyes hidden by tentacular segment. Tentacular segment indistinctly separated from prostomium, achaetous, with 2 pairs of short subequal tentacular cirri, lateral and ventrolateral; ventrally forms lower lip of mouth. Dorsal cirri of first setiger similar to following. Parapodia subbiramous. Notopodial lobe low, inflated, with internal notoaciculum curving distally, with short digitiform dorsal cirrus shorter than neuropodial lobe; with stout emergent hooked acicular setae beginning on setiger 3. Neuropodium short, rounded, with retractile conical neuroacicular lobe, with bundle of about 5 neurosetae. Neurosetae simple, variable in length, longest ones smooth, tapering to fine tips, shorter ones finely spinous, all ending in slightly bent tips. Ventral cirri short, subequal to dorsal cirri, beginning on setiger 3. Pygidium rounded, with paired short subulate anal cirri. Proboscis not extended. Anterior part of digestive tract (in setigers 3–6) looped; with segmental intestinal caeca, 2 pairs per segment. Integument with scattered minute papillae, on body and appendages.

A. hartmanae may be separated from the other species of *Ancistrosyllis* as indicated in the key on page 165.

Distribution: Chesapeake Bay. In 7 fms.

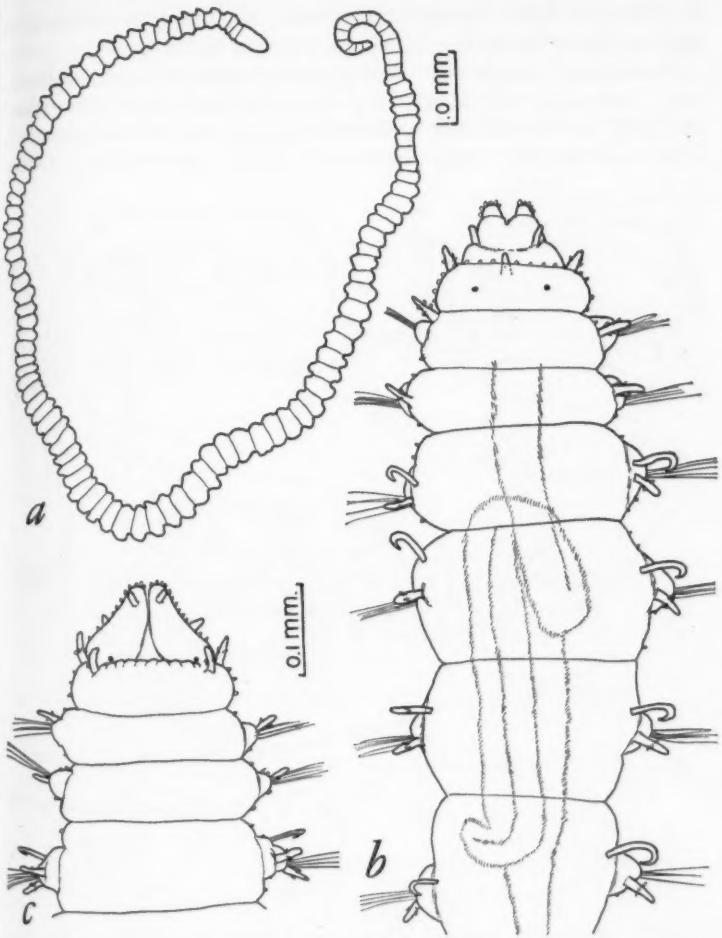

FIGURE 7.—*Ancistrosyllis hartmanae*, new species: *a*, general outline of animal; *b*, dorsal view anterior end, with looped part of digestive tract in setigers 3–6 shown; *c*, ventral view anterior end.

Ancistrosyllis jonesi, new species

FIGURES 9, 10

The species is based on 3 incomplete specimens collected by Marvin Wass in Chesapeake Bay off Rappahanock River in 7 fathoms in mud, July 21, 1961, holotype USNM 30983, 37°36′ N., 76°06′ W., and 2 paratypes USNM 30984, 37°32′ N., 76°07′ W. The species is named

for Meredith Jones, expressing in a small way my appreciation for his help and cooperation in our field of common interest.

Description: Length of incomplete holotype 16 mm., width 1.5 mm., segments 44. Body long, flattened dorsoventrally, tapered gradually anteriorly, with parapodia deeply cut. Prostomium with large subtriangular palpophores and minute palpostyles. Lateral

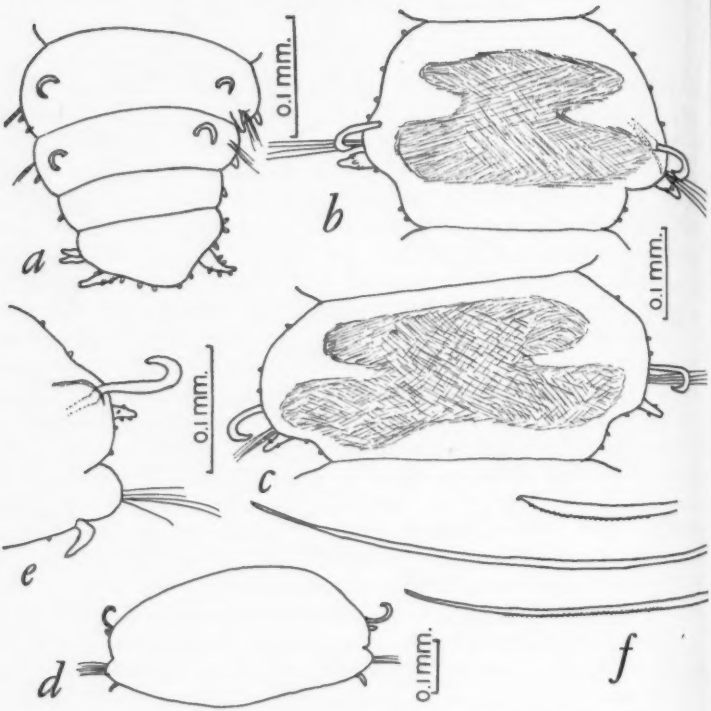

FIGURE 8.—*Ancistrosyllis hartmanae*, new species: *a*, dorsal view posterior end; *b*, dorsal view setiger 15, with intestinal caeca shown; *c*, same, from setiger 36; *d*, general outline of cross section through middle of body (about setiger 50); *e*, parapodium from same; *f*, neurosetae.

antennae short, subulate, shorter than palpophores. Posterior median antenna minute, easily overlooked. Without definite eyes but with brownish scattered pigment on posteriolateral parts of prostomium and tentacular segment. Tentacular segment indistinct from prostomium, achaetous, with 2 pairs of short, subulate, subequal tentacular cirri; ventrally forms lower lip of mouth. Dorsal cirri of first setiger slightly longer than following.

Parapodia subbiramous. Notopodia enlarged, inflated, conical, extending nearly to tips of neuropodial lobes, with notoacicula curving distally and enclosing extensions of intestinal caeca; dorsal cirri small, indistinctly separated from enlarged notopodial lobes; with stout emergent hooked notosetae beginning on setiger 6. Neuropodia

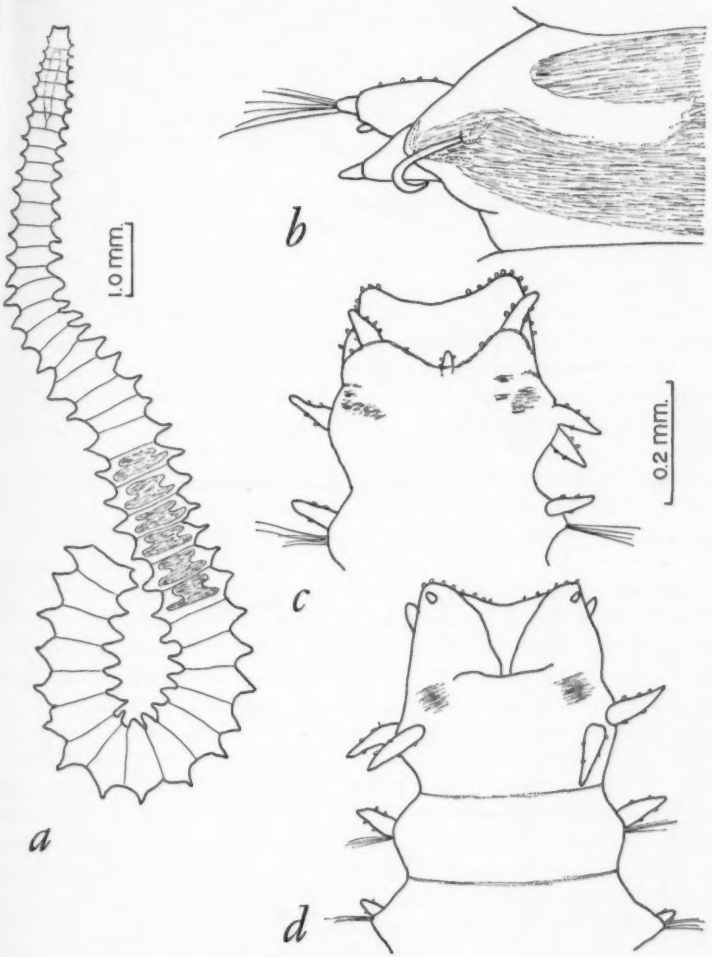

FIGURE 9.—*Ancistrosyllis jonesi*, new species (from holotype): *a*, general outline of incomplete holotype of 44 segments, outline of intestinal caeca shown in few segments; *b*, dorsal view parapodium, outline of intestinal caeca shown; *c*, dorsal view anterior end; *d*, ventral view anterior end.

conical, with tips truncate, with neuroaciculum and bundle of about 8 simple neurosetae; neurosetae variable in length, longest smooth, tapering to fine tips, shorter very finely spinous, shortest more coarsely spinous, all with slightly hooked tips which may be indistinctly bifid. Ventral cirri digitiform, extending beyond neuropodial lobes,

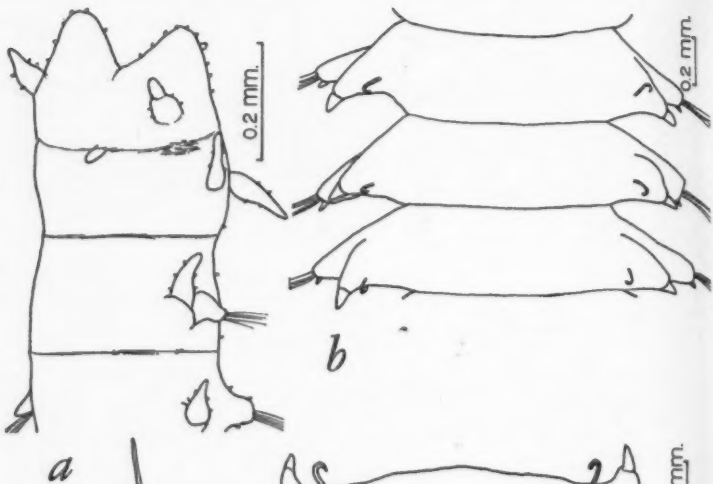

FIGURE 10.—*Ancistrosyllis jonesi*, new species (from paratype): *a*, dorsolateral view anterior end; *b*, dorsal view setigers 25–27; *c*, cross section body in region of setiger 30; *d*, parapodium of same, outline of intestinal caeca shown; *e*, neurosetae.

beginning on setiger 3. Pygidium? Proboscis not extended. Intestine with intestinal caeca, two pairs per segment, shorter anterior pair and longer posterior pair extending into notopodia. Integument with scattered minute papillae.

A. jonesi may be distinguished from the other species of *Ancistrosyllis* as indicated in the key on page 165. It is closest to *A. hamata*, differing by the development of the enlarged conical notopodial lobes and the small median antenna.

Distribution: Chesapeake Bay. In 7 fms.

Genus *Cabira* Webster, 1879, revised

Cabira Webster, 1879. [Type-species: *C. incerta* Webster, 1879, by monotypy. Gender: feminine.]

Remarks: *Cabira* was placed by Webster among "genera incertae sedis." The brief description of *C. incerta* is confused, particularly in regard to the parapodial rami. Fauvel (1920) referred the species to *Ancistrosyllis* among the Hesionidae, suggesting that perhaps the median antenna was lost. Hartman (1947) placed it in the Pilargidae and suggested that the name *Cabira* perhaps best be dropped, since the original account is much too faulty and incomplete.

The type of *Cabira incerta* has not been found in the U.S. National Museum, where most of Webster's polychaete material was deposited. As far as can be determined, it no longer exists. Among the pilargids collected in Chesapeake Bay off Rappahanock River, dredged in 7 fms. in mud by Marvin Wass, are five specimens which can be identified with *Cabira incerta*. I am herewith revising the genus and species, based on this new material.

Diagnosis: Body subcylindrical, with parapodia poorly developed. Prostomium small, with paired biarticulate palps consisting of large palpophores and very small palpostyles; with paired small lateral antennae (lacking in *C. capensis*); without median antenna. Tentacular segment indistinct from prostomium, achaetous, with 2 pairs of very small tentacular cirri. Parapodia poorly developed, subbiramous; notopodia represented by notoacicula and small dorsal cirri, with emergent stout hooked notosetae beginning on setigerous segments 6–8; neuropodia small, with neuroacicula and few similar neurosetae; neurosetae simple, delicate, capillary (additional short setae in *C. brevicirris*); ventral cirri small, below or at tips of neuropodia. Pygidium bilobed, without anal cirri. Proboscis cylindrical, sometimes ringed, with longitudinal basal rows of spines (in type-species) or with soft papillae (*C. brevicirris*).

According to this revision, *Cabira* includes the following:

C. incerta Webster, 1879, p. 267. Chesapeake Bay, Virginia.

C. pilargiformis (Uschakov and Wu, 1962, p. 75), as *Ancistrosyllis pilargiformis*. Yellow Sea.

C. capensis (Day, 1963, p. 396), as *Loandalia capensis*. South Africa.
C. brevicirris (Rangarajan, 1964, p. 122), as *Ancistargis brevicirris*. South India.

Key to the Species of *Cabira*

1. Lateral antennae lacking. Ventral cirri small, at tips of neuropodial lobes. Hooked notosetae begin on setiger 8. Integument papillated. Proboscis soft sac . . . . . C. capensis
   With pair small lateral antennae. Ventral cirri small, below neuropodial lobes. Integument smooth or with only few scattered papillae 2
2. Neurosetae of 2 kinds, slender capillary and short, with slightly recurved tips. Hooked notosetae begin on setigers 6–8. Proboscis with numerous, conical, soft papillae. . . . . C. brevicirris
   Neurosetae all similar, slender, capillary. 3
3. Hooked notosetae begin on setiger 7. Proboscis with longitudinal rows of spines basally . . . . . C. incerta
   Hooked notosetae begin on setiger 6. Proboscis? . . . . . C. pilargiformis

Cabira incerta Webster, 1879, revised

FIGURES 11, 12

Cabira incerta Webster, 1879, p. 267, pl. 11, figs. 155–157.—Hartman, 1947, p. 510. *Ancistrosyllis incerta* Fauvel, 1920, p. 211.

Material examined: Chesapeake Bay off Rappahanock River, 37°32′N., 76°07′W., 7 fms., mud, July 21, 1961, Marvin Wass, collector, 5 specimens.

Description: Length to 18 mm., width to 1.5 mm., segments to 54. Body long, subcylindrical, flattened ventrally, arched dorsally, narrowest anteriorly, with indistinct segmental bulges (more prominent posteriorly). Prostomium and tentacular segment fused, with paired biarticulate palps consisting of large palpophores and small ventral palpostyles, with numerous papillae concentrated on anterior tips (=membranous expansions or thin plates covered with papillae of Webster); with pair very short lateral antennae arising from swollen bases or ceratophores indistinctly set off from prostomium. Tentacular segment achaetous, with 2 pairs of very short tentacular cirri.

Parapodia small, indistinct, subbiramous. Notopodium (=ventral ramus of Webster) represented by very small notopodial lobe or dorsal cirrus with internal notoaciculum, with stout emergent hooked notoseta (=strong hooked ventral seta of Webster) beginning on setiger 7 (setiger 6, according to Webster); sometimes with additional hooked seta in process of formation internally, indicating probable replacement of hooked setae (figs. 12*a*, *b*). Neuropodium (=dorsal ramus of Webster) short, conical, with neuroaciculum, tip of which sometimes projects slightly and few (2–4) similar neurosetae (=dorsal setae of Webster); neurosetae simple, slender, delicate, tapering to capillary tips; ventral cirri (=dorsal cirri of Webster) short, digitiform, below neuropodial lobe, beginning on setiger 3. Pygidium short,

bilobed, without anal cirri. Proboscis cylindrical, 3-ringed, with large papillae around opening of distal ring and few scattered micropapillae, with thickened cuticle in basal ring forming longitudinal ridges, of

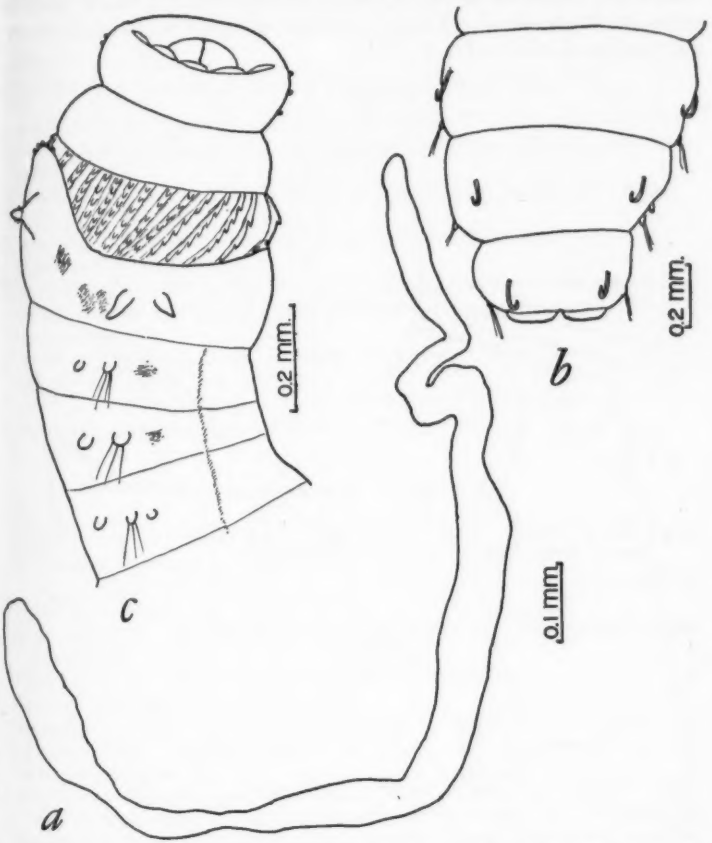

FIGURE 11.—*Cabira incerta:* *a*, general outline of complete specimen; *b*, dorsal view posterior end; *c*, lateral view anterior end with proboscis extended.

jagged spines. Integument mostly smooth, with few scattered papillae. Sometimes pigmented areas dorsal to tentacular cirri and ventral to neuropodia on first 2 setigers (fig. 11*c*).

Distribution: Chesapeake Bay, Va. In 7 fms.

Genus *Sigambra* Müller, 1858

Sigambra Müller, 1858. [Type-species: *S. grubii* Müller, 1858, by monotypy Gender: feminine.]

The genus *Sigambra* either has been overlooked or has been considered to be indeterminable (Hartman, 1947, p. 483; 1959, p. 195). The original figures and brief description of *S. grubii* from Santa Catharina Island off Brazil seem to be sufficiently good to allow the genus to be retained. I have included on page 182 the figures and description of Müller for *S. grubii*.

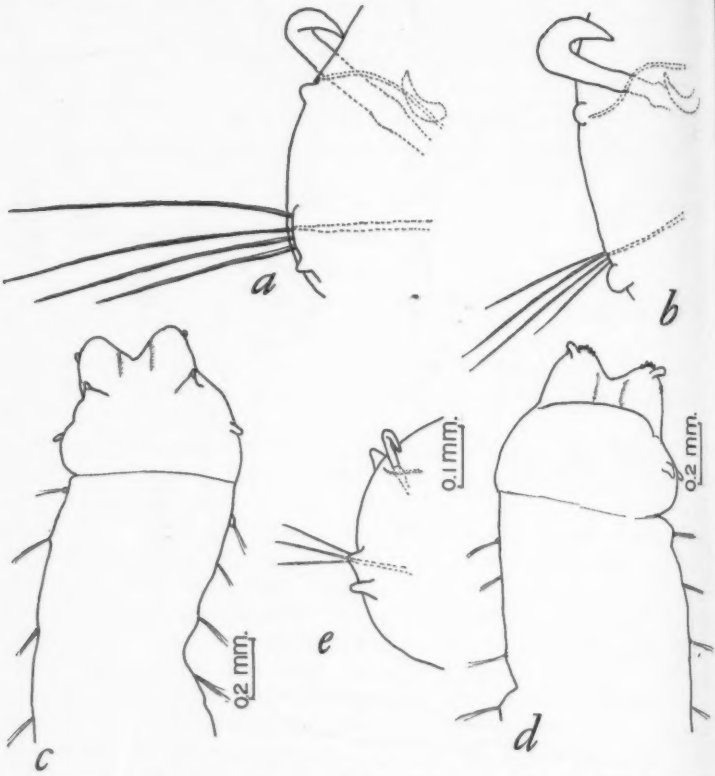

FIGURE 12.—*Cabira incerta:* *a*, parapodium from setiger 8; *b*, same, from setiger 18; *c*, dorsal view anterior end; *d*, ventral view anterior end; *e*, parapodium from setiger 40.

Diagnosis: Body long, flattened, with parapodia deeply cut. Prostomium with 2 biarticulate palps, 3 antennae longer than palps. Tentacular segment achaetous, more or less fused to prostomium and first setigerous segment, with 2 pairs tentacular cirri. First setigerous segment with longer paired dorsal cirri. Parapodia subbiramous. Notopodia with notoacicula and stout emergent hooked setae. Dorsal cirri long, slender, or flattened leaflike, extending beyond neuropodia.

Neuropodia conical, with neuroacicula and simple neurosetae; neurosetae capillary, smooth and spinous. Ventral cirri shorter, subulate. Pygidium with paired long anal cirri. Proboscis unarmed, cylindrical, with distal circlet of large conical papillae or indistinctly papillate. With intestinal caeca. Integument smooth (not papillated), may be areolated or wrinkled.

The following species are herein referred to *Sigambra:*

S. grubii Müller, 1858, p. 214. Santa Catharina Island, Brazil. See page 182.

S. robusta (Ehlers, 1908, p. 59), as *Ancistrosyllis robusta.* South Atlantic Ocean.

S. constricta (Southern, 1921, p. 573), as *Ancistrosyllis constricta.* Chilka Lake, India.

S. tentaculata (Treadwell, 1941, p. 1), as *Ancistrosyllis tentaculata.* Long Island, N.Y. See page 182.

S. bassi (Hartman, 1947, p. 501), as *Ancistrosyllis bassi.* Florida. See page 186.

S. ocellata (Hartmann-Schröder, 1959, p. 109), as *Ancistrosyllis ocellata.* Central America.

S. hanaokai (Kitamori, 1960, p. 1086), as *Ancistrosyllis hanaokai.* Seto-Inland Sea, Japan.

S. parva (Day, 1963, p. 395), as *Ancistrosyllis parva.* South Africa.

S. wassi, new species. Chesapeake Bay. See page 186.

Key to the Species of *Sigambra*

1. Dorsal cirri only slightly longer than ventral cirri. Dorsal hooked setae beginning on setiger 7. Ventral cirri on setiger 2? Very small, young? **S. ocellata**
   Dorsal cirri longer than ventral cirri 2
2. Stout hooked notosetae beginning anterior to setiger 20. Ventral cirri lacking on setiger 2 3
   Stout hooked notosetae beginning posterior to setiger 20 6
3. Hooked setae beginning on setiger 4 4
   Hooked setae beginning on about setiger 14 (11–15) . . . **S. bassi,** p. 186
4. Median antenna longer than lateral antennae. . . . **S. tentaculata,** p. 182
   Antennae subequal 5
5. Longer neurosetae finely spinous basally, with capillary tips; shorter neurosetae wide, coarsely spinous, tapering to very short bare tips . **S. hanaokai**
   Longer neurosetae smooth, capillary; shorter neurosetae coarsely spinous, with capillary tips . . . . . **S. parva**
6. Body constricted at setiger 4. Without ventral cirri on setiger 2. Notopodial hooked setae beginning about setiger 30–40. Dorsal cirri fusiform, tapered. **S. constricta**
   Body not constricted at setiger 4. With ventral cirri on all setigers . . . 7
7. Dorsal cirri fusiform, tapered. Notopodial hooked setae beginning about setiger 70 . . . . . **S. robusta**
   Dorsal cirri wide, flattened, leaflike. Notopodial hooked setae beginning about setiger 23–30 . . . . . **S. wassi,** p. 186

Note: *S. grubii* is omitted from key, since the original description failed to mention on which setiger the hooked setae begin. See page 182.

Sigambra grubii Müller

FIGURE 13

Sigambra grubii Müller, 1858, p. 214, pl. 6, figs. 7–9.

The figures and description have been taken from Müller (freely translated from the German).

Description: Body with numerous short segments. Prostomium indistinct from longer tentacular segment and first setigerous segment, with bilobed frontal part and 2 minute frontal papillae (=biarticulate palps), with 3 occipital antennae, without eyes. Tentacular segment achaetous, with 2 pairs of tentacular cirri. First setigerous segment with upper pair of dorsal cirri very long, about 4 times longer than ventral cirri. Parapodia subbiramous. Notopodium with notoaciculum and single emergent notoseta (setiger on which hooked setae begin not indicated; at least posterior to setiger 3, as indicated by fig. 13*a*); dorsal cirri long, slender, subulate, extending beyond neurosetae. Neuropodium with neuroaciculum and bundle of simple neurosetae. Ventral cirri short, filiform, lacking on setiger 2 (at least not shown in fig. 13*a*). Pygidium with pair of long anal cirri. Proboscis cylindrical, with row of papillae. Intestine with lateral projections in bases of parapodia. Blood yellowish.

Distribution: South Atlantic, Santa Catharina Island off Brazil.

Sigambra tentaculata (Treadwell)

FIGURES 14, 15

Ancistrosyllis tentaculata Treadwell, 1941, p. 1, figs. 1–3.—Hartman, 1963, p. 13; 1965, p. 71.

Material examined: Holotype from Long Island, N.Y., loan from AMNH, no. 2893. York River, Va., mud, November 1960, M. Wass, coll. Chesapeake Bay off Rappahanock River, sand, June 1962, M. Wass, coll. Off Port Aransas, Tex., 27°49′ N., 97°01.6′ W., 5 fms., mud, M. Jones, coll. (AMNH).

Description: Length to 15 mm., width to 2 mm., segments to 91. Body somewhat inflated and widest anteriorly, tapered gradually posteriorly, flattened dorsoventrally, with parapodia deeply cut, as long as body width. Integument smooth, without papillae. Prostomium variable in shape, posterior margin sometimes appearing indented posteriorly and extending on tentacular segment as indicated by Treadwell for the holotype (fig. 14*a*), possibly due to rather shrunken condition of specimen; biarticulate palps with large palpophores indistinctly separated from prostomium, with small button-like to filiform palpostyles; median antenna on posterior part of prostomium, extending far beyond palps; lateral antennae slightly more anterior than median antenna and extending slightly beyond palps; without definite eyes but sometimes with deep irregular pigmented areas lateral

to antennae and crescent-shaped areas posterior to lateral antennae (fig. 15*a*). Tentacular segment longer than following segment, with 2 pairs of tentacular cirri similar to lateral antennae. Dorsal cirri of first setiger longer than following ones, similar to and longer than median antenna.

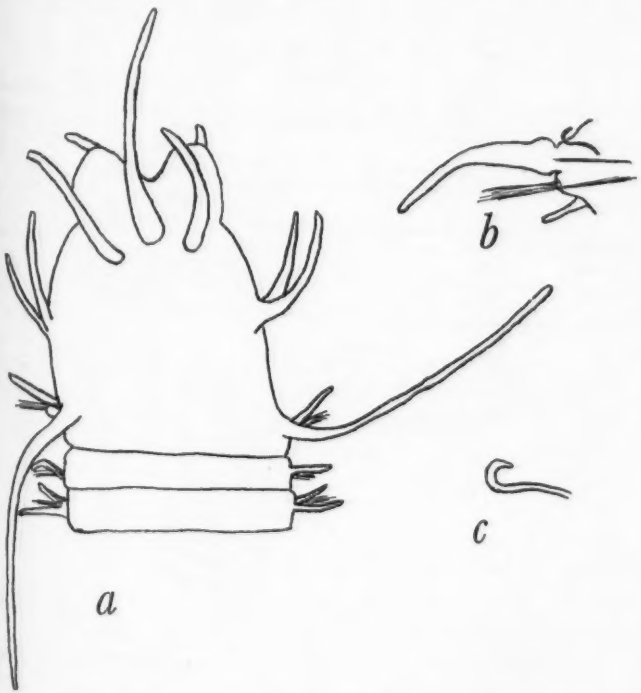

FIGURE 13.—*Sigambra grubii* (figures taken from Müller, 1858): *a*, dorsal view anterior end; *b*, parapodium; *c*, notopodial hooked seta.

Parapodia subbiramous; notopodia low, conical, with notoaciculum curving distally; stout, hooked, emergent notoseta beginning on setiger 4. Dorsal cirri wide basally, tapering distally, extending beyond setal lobes. Neuropodia conical, with neuroaciculum and numerous simple neurosetae. Neurosetae variable in length, longer ones smooth, capillary, shorter ones spinous with fine tips. Ventral cirri slender, subulate, shorter than setal lobes, lacking on setiger 2. Pygidium with 2 long anal cirri. Proboscis with 14 papillae around opening, with additional basal papillae irregularly distributed.

Small specimens apparently of this species from Port Aransas, Tex. (14 to 23 setigerous segments, fig. 15*e*) agree generally with the larger

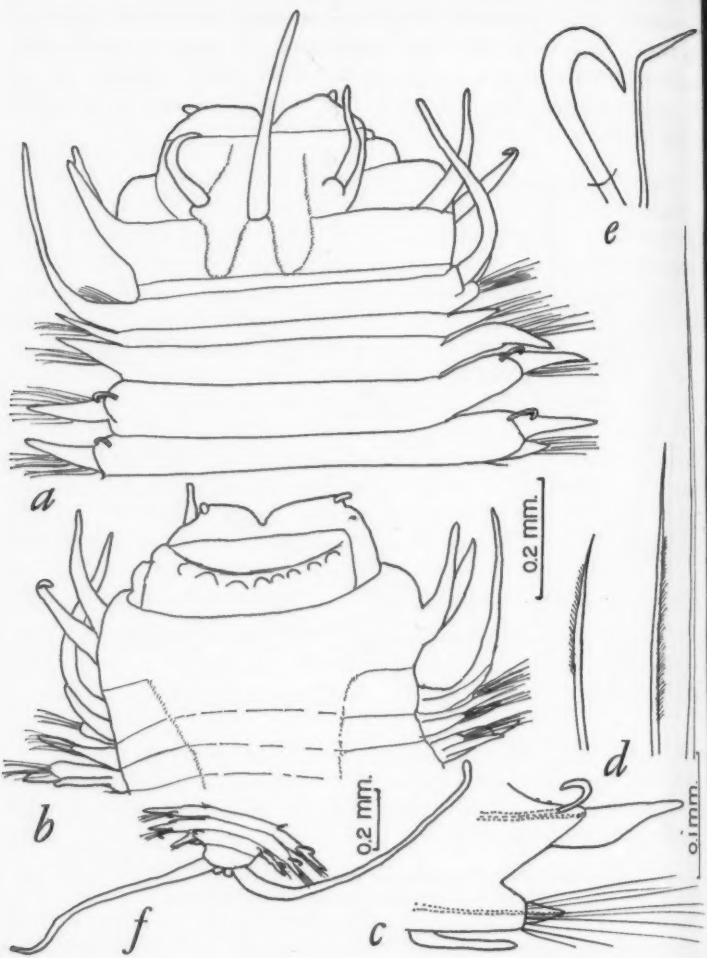

FIGURE 14.—*Sigambra tentaculata* (*a-d*, from holotype from Long Island, N.Y.; *e*, *f*, from specimens from York River): *a*, dorsal view anterior end, proboscis partially extended (specimen rather shrunken, the prostomial area extending on tentacular segment may not be natural); *b*, same, ventral view; *c*, parapodium; *d*, neurosetae; *e*, curved notoaciculum and stout hooked notoseta; *f*, ventral view posterior end.

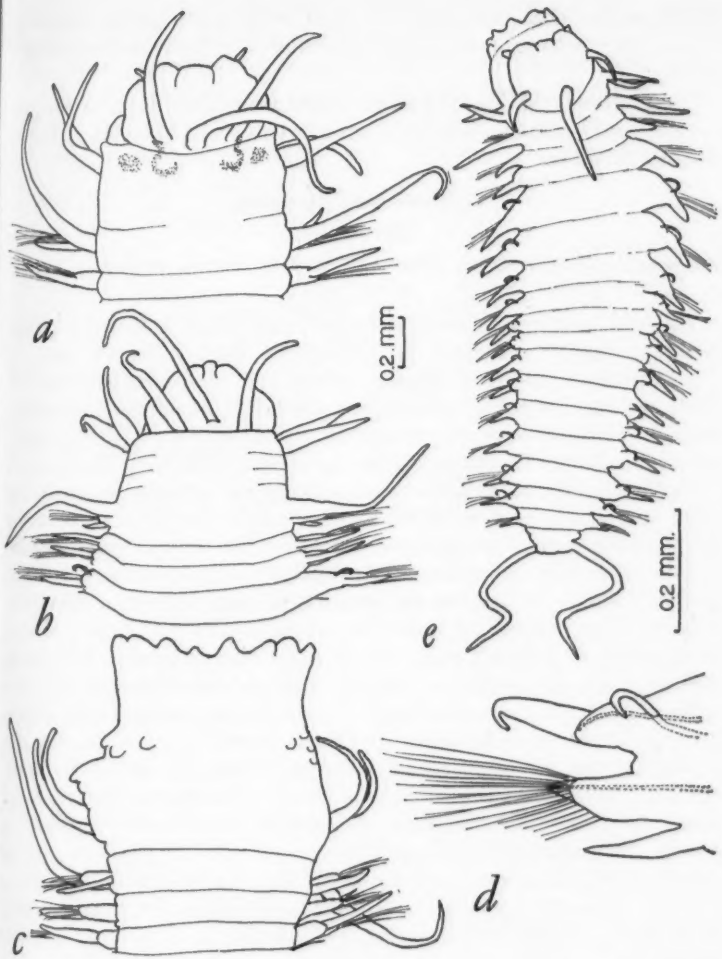

FIGURE 15.—*Sigambra tentaculata* (*a-d*, from specimens from York River; *e*, from specimen from Port Aransas, Tex.): *a*, dorsal view anterior end; *b*, same, from another specimen; *c*, ventral view anterior end, with proboscis extended; *d*, parapodium from middle region; *e*, small specimen of 14 setigerous segments, with proboscis extended.

specimens, including notopodial hooked setae beginning on setiger 4, ventral cirri lacking on setiger 2; segmental intestinal caeca especially prominent.

Distribution: Off New England, Chesapeake Bay, Gulf of Mexico (Texas), northeastern South America, southern California. Intertidal to 2800 fms.

Sigambra bassi (Hartman)

FIGURE 16

Ancistrosyllis bassi Hartman, 1945, p. 15; 1947, p. 501, pl. 61, figs. 1–7; 1951, p. 36, pl. 11, figs. 1–6.

Material examined: Paratype from Florida, N 1713, loan from Olga Hartman (AHF). Seahorse Key, Fla., Oct. 1960, J. Taylor, coll.

Description: Length to 40 mm., width to 2 mm., segments to 146. Body widest anteriorly, tapered posteriorly, flattened dorsoventrally, with parapodia deeply cut, longer than body width. Color (in life): greenish yellow. Integument smooth, without papillae. Prostomium with biarticulate palps with large palpophores indistinctly separated from prostomium and small button-like palpostyles; median antenna on posterior part of prostomium extending far beyond palps; lateral antennae slightly more anterior to median antenna, extending little beyond palps. Tentacular segment longer than following ones, with 2 pairs of tentacular cirri similar to lateral antennae. Dorsal cirri of first setigerous segment long, similar to median antenna. Parapodia subbiramous; notopodia low conical, with notoaciculum curving distally, with stout notopodial hooked notoseta beginning about setiger 14 (11–15); occasionally additional single emergent notoseta, straight or slightly curved (called an aciculum by Hartman); dorsal cirri long, subulate, extending far beyond setal lobes. Neuropodia conical, with neuroaciculum and numerous neurosetae; neurosetae variable in length, all ending in capillary tips, longer ones slender, smooth or faintly serrated, shorter ones serrated; ventral cirri extending slightly beyond setal lobes, lacking on setiger 2. Pygidium with paired long anal cirri. Proboscis cylindrical, with circlet of 14 conical papillae distally.

Distribution: North Carolina, Florida, central and southern California. Intertidal to 18 fms.

Sigambra wassi, new species

FIGURES 17, 18

The species is based on two specimens from Chesapeake Bay, off Rappahanock River, collected by Marvin Wass, holotype (incomplete posteriorly) USNM 30988, 37°37.3′ N., 75°59′ W., sand, 6 fms., June 1962; paratype (broken and in 3 pieces) USNM 30987, 37°37′ N.,

76°11′ W., mud, 7 fms., July 1961. The species is named for Marvin Wass who collected the specimens.

Description: Length of incomplete holotype 45 mm., width 5 mm., segments 107; length of paratype (in 3 pieces) 70 mm., width 4 mm., segments 192. Body large, somewhat flattened, convex dorsally, flattened ventrally with midventral depression, tapered gradually

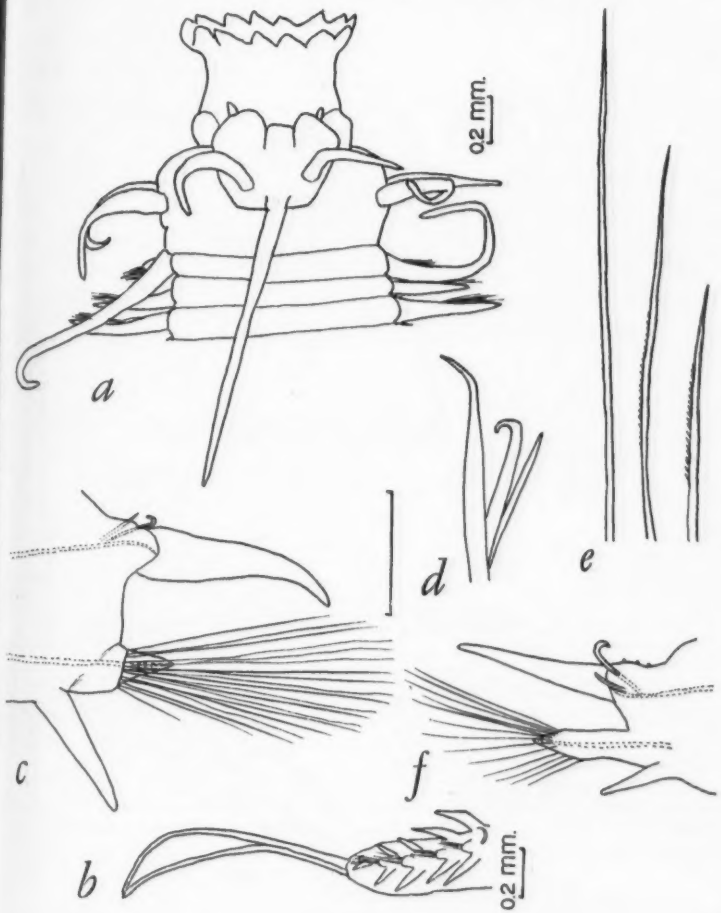

FIGURE 16.—*Sigambra bassi* (*a-e*, from paratype from Florida, AHF 1713; *f*, from specimen from Seahorse Key, Fla.): *a*, dorsal view anterior end; *b*, lateral view posterior end; *c*, middle parapodium; *d*, notoaciculum and notosetae from same; *e*, neurosetae from same; *f*, middle parapodium.

posteriorly, with parapodia long (about as long as body width), thick, flattened anteroposteriorly. Integument smooth (not papillated), wrinkled and areolated, especially in anterior and middle regions of body. Prostomium with biarticulate palps consisting of large palp-

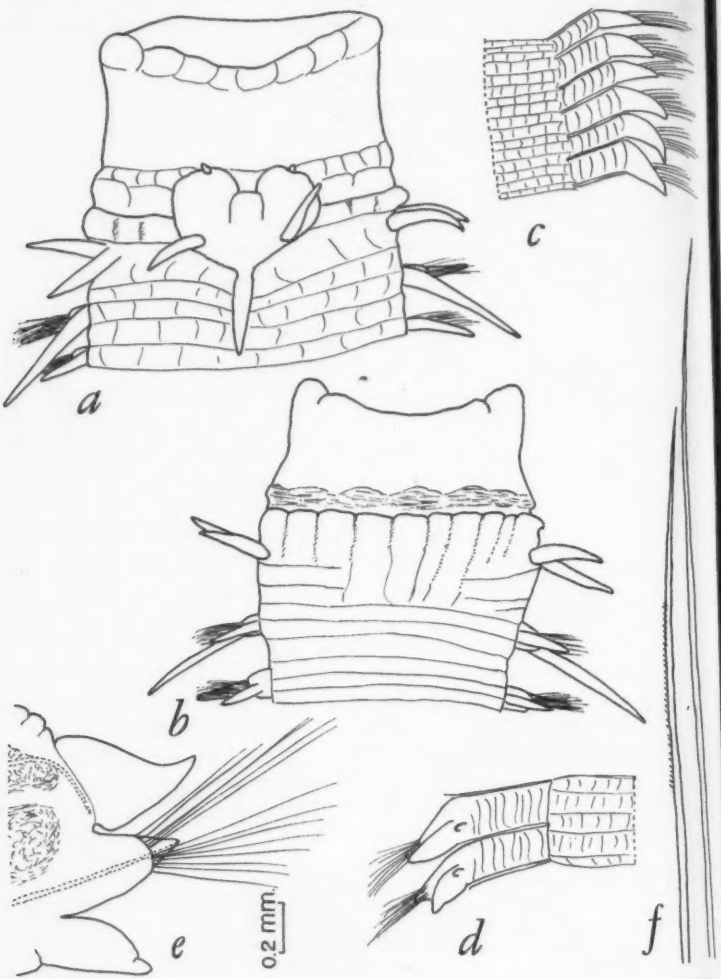

FIGURE 17.—*Sigambra wassi*, new species (from holotype): *a*, dorsal view anterior end with proboscis extended; *b*, same, ventral view; *c*, dorsal view few segments from anterior region; *d*, same, from middle region; *e*, parapodium from setiger 15, with intestinal caeca indicated; *f*, neurosetae from same.

ophores indistinctly set off from rest of prostomium and small palpostyles; medium antenna on posterior part of prostomium, extending to tips of palps; lateral antennae more anterior and slightly shorter than median antenna. Tentacular segment achaetous, longer than following, with 2 pairs of subequal tentacular cirri, similar to median antenna. Dorsal cirri of first setigerous segment longer than following.

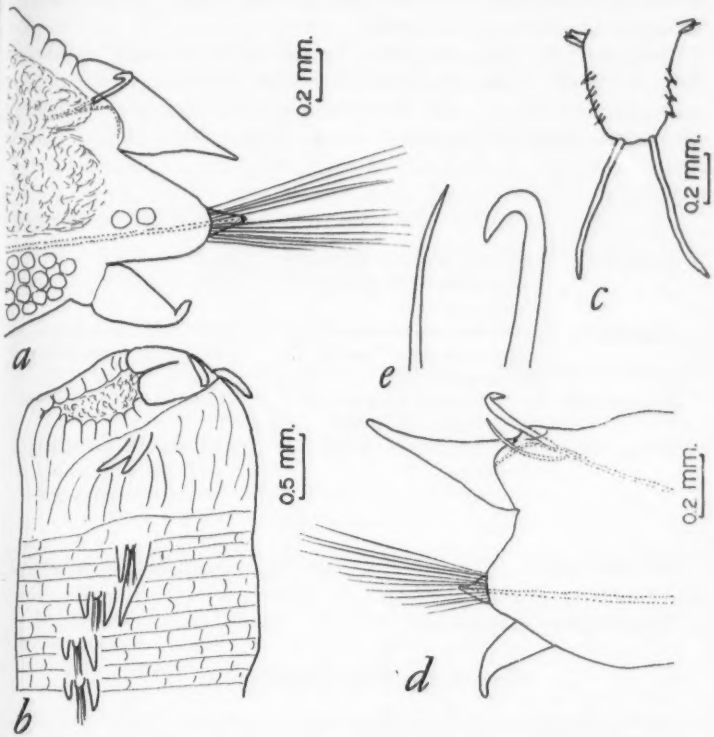

FIGURE 18.—*Sigambra wassi*, new species (*a*, from holotype; *b-e*, from paratype): *a*, parapodium from setiger 50, with intestinal caeca and eggs indicated; *b*, lateral view anterior end; *c*, dorsal view posterior end; *d*, parapodium from posterior region; *e*, notosetae from same.

Parapodia subiramous, as long as body width, thick, with large intestinal dark caeca and with eggs in base (in holotype). Notopodial lobe low, indistinct, with notoacicula curving distally, with emergent acicular seta visible externally about setiger 25 (23/25 in holotype, 30/31 in paratype); in addition, with extra single curved pointed

notoseta in posterior segments (figs. 18*d*,*e*). Dorsal cirri large, flattened, leaflike, wide basally, tapering distally, extending beyond neuropodial lobes. Neuropodium conical with neuroaciculum and numerous silky neurosetae. Neurosetae simple, shorter and coarsely spinous to longer and faintly spinous, all tapering to capillary tips. Ventral cirri beginning on setiger 1, present on all setigers, subulate, slightly shorter than dorsal cirri. Pygidium with 2 long anal cirri. Proboscis cylindrical, with indefinite papillae around opening and with irregular papillated area basally.

Remarks: *S. wassi* superficially resembles the figures given for *Otopsis longipes* Ditlevsen, both being large, flattened, with integument wrinkled and folded, with dorsal and ventral cirri large, lamelliform and with numerous capillary setae. They differ in the following characters:

	Otopsis longipes Ditlevsen	*Sigambra wassi*, new species
Segment I:	Tentacular segment achaetous, with 2 pairs of subequal tentacular cirri	Same
Segment II:	Second tentacular segment achaetous with 1 pair of tentacular cirri	First setigerous segment with long dorsal cirri and shorter ventral cirri
Segment III:	First setigerous segment with dorsal and ventral cirri	Second setigerous segment
Notopodia:	With 2 notoacicula, without notosetae	With single notoaciculum and emergent hooked notoseta beginning on setiger 23–31

S. wassi differs from the other species of *Sigambra* as indicated in the key on page 181.

Distribution: Chesapeake Bay, Va. In 6–7 fms.

Genus *Synelmis* Chamberlin, 1919

Synelmis Chamberlin, 1919. [Type-species: *S. simplex* Chamberlin, 1919, by original designation and monotypy; = *S. albini* (Langerhans, 1881). Gender: neuter.]

Kynephorus Ehlers, 1920. [Type-species: *K. inermis* Ehlers, 1920, by monotypy; = *S. albini* (Langerhans, 1881). Gender: masculine.]

Glyphohesione Friedrich, 1950. [Type-species: *G. klatti* Friedrich, 1950, by monotypy. Gender: feminine.]

Diagnosis: Body long, subcylindrical, stiff, wiry, with lateral parapodia sharply marked off from body. Prostomium small, with paired biarticulate palps, 3 antennae. Tentacular segment achaetous, with 2 pairs of tentacular cirri. Parapodia subbiramous. Notopodia with notoacicula and stout, emergent, straight or slightly curved,

acicular setae (not hooked); dorsal cirri short, subulate. Neuropodia cylindrical, with neuroacicula and simple neurosetae; neurosetae capillary, limbate; ventral cirri short, subulate. Pygidium with paired short anal cirri. Proboscis unarmed, cylindrical. Without intestinal caeca. Integument smooth, with thick, highly iridescent cuticle, not papillated or areolated.

A single species has previously been referred to *Synelmis*, *S. simplex* Chamberlin, 1919, p. 177. Tuamotu Islands, South Pacific. Herein referred to *S. albini* (Langerhans), see below.

A single species has previously been referred to *Kynephorus*, *K. inermis* Ehlers, 1920, p. 27. Amboina, Indonesia. Herein referred to *S. albini* (Langerhans), see below.

A single species has been described previously under *Glyphohesione*, *G. klatti* Friedrich, 1950, p. 169. Off Helgoland, North Sea. See Eliason, 1962, p. 29, as *Ancistrosyllis klatti*. Herein referred to *Synelmis*, perhaps young of *S. albini*?

Other species were described under *Ancistrosyllis* and are being referred to *Synelmis albini*. See below and page 165.

Key to the Species of *Synelmis*

1. Dorsal cirri of first setiger similar to following. Dorsal and ventral cirr subequal . . . . . **S. albin**
   Dorsal cirri of first setiger about 2 times longer than following. Dorsal cirr longer than ventral cirri, extending beyond parapodial lobes . . **S. klatt**

Synelmis albini (Langerhans)

FIGURES 19–21

Ancistrosyllis albini Langerhans, 1881, p. 107, fig. 16, a–e.—Hartman, 1965, p. 70.
Synelmis simplex Chamberlin, 1919, p. 177, pl. 28, figs. 1–5.
Ancistrosyllis rigida Fauvel, 1919, p. 337, fig. 1, a–e; 1932, p. 64; 1953, p. 7.—Augener, 1927, p. 50.—Hartman, 1947, p. 498, pl. 62, figs. 1–7; 1954, p. 629.
Kynephorus inermis Ehlers, 1920, p. 27, pl. 3, figs. 1–9.
Ancistrosyllis gracilis Hessle, 1925, p. 34, fig. 12.
Ancistrosyllis gorgonensis Monro, 1933a, p. 26, fig. 12, a–d.

Remarks: *Ancistrosyllis albini*, described by Langerhans in 1881 from the Canary Islands, was evidently overlooked by Chamberlin, 1919 (*Synelmis simplex*), Fauvel, 1919 (*Ancistrosyllis rigida*), and Ehlers, 1920 (*Kynephorus inermis*). Augener, 1927, synonomized *K. inermis* with *A. rigida*. He also suggested that both *inermis* and *rigida* might well be referred to *A. albini* and that the apparent differences could be due to preservation, since *A. albini* was described and figured from a living specimen and not contracted due to preservation, as in the specimens described by the other authors. Hessle, 1925 (*A. gracilis*) and Monro, 1933a (*A. gorgonensis*) indicated that their respective species were close to *A. rigida* and *A. albini*. Hartman,

1947, referred *A. gorgonensis* to *A. rigida*. The tubercles on the cirri of *A. gracilis*, mentioned and figured by Hessle, appear to be internal structures and not external papillae as in some other pilargids. The presence or absence of shorter neuropodial forked setae is not a good character, since the forked setae appear to be formed by fracture and splitting of the longer neurosetae; thus they are variable in occurrence and appearance.

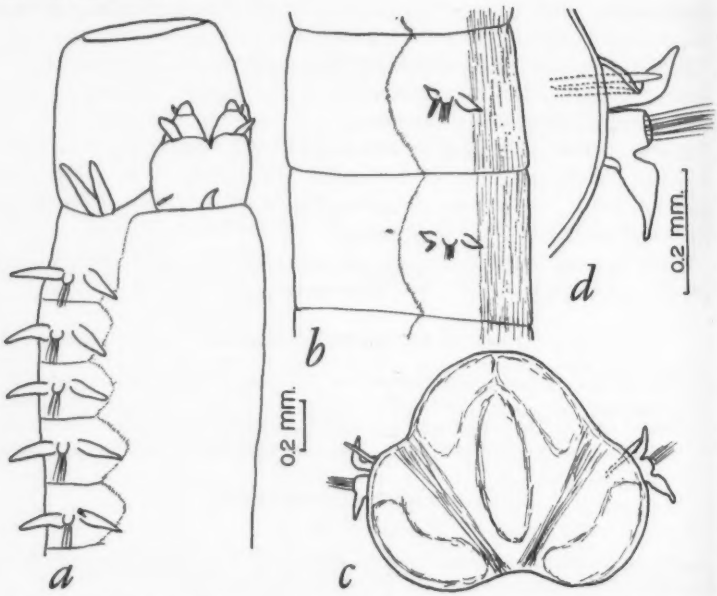

FIGURE 19.—*Synelmis albini* (from specimen from Antigua): *a*, dorsolateral view anterior end, with proboscis partially extended; *b*, lateral view segments 49–50; *c*, outline of cross section in region of setiger 50; *d*, parapodium from same, the thick cuticle shown.

Material examined: Holotype and paratype of *Synelmis simplex* Chamberlin, Tuamotu Islands, South Pacific, USNM 19480, 19481. Saipan, Marshall Islands, Central Pacific. Ft. Barclay, English Harbor, Antigua, Barbados-Antigua Expedition, 1918. Dry Tortugas, Fl., 1914 (AMNH). Old Tampa Bay, Fla., January 1959, M. L. Jones (4 small spec.; AMNH).

Description: Length to 60 mm., width to 1.5 mm., segments to 170. Body elongate, subcylindrical, tapered posteriorly, segmental grooves indistinct anterodorsally, with parapodia distinctly set off from body, having general aspect of a goniadid (may have distinct midventral and dorsolateral grooves when preserved, as in some opheliids, fig. 19c). Prostomium with pair of biarticulate palps sometimes turned ven-

trally; palpophores large, oval; palpostyles small, oval, sometimes retracted within palpophores; with additional ventrolateral papilla on palpostyles; with 3 short antennae, lateral pair and posterior median;

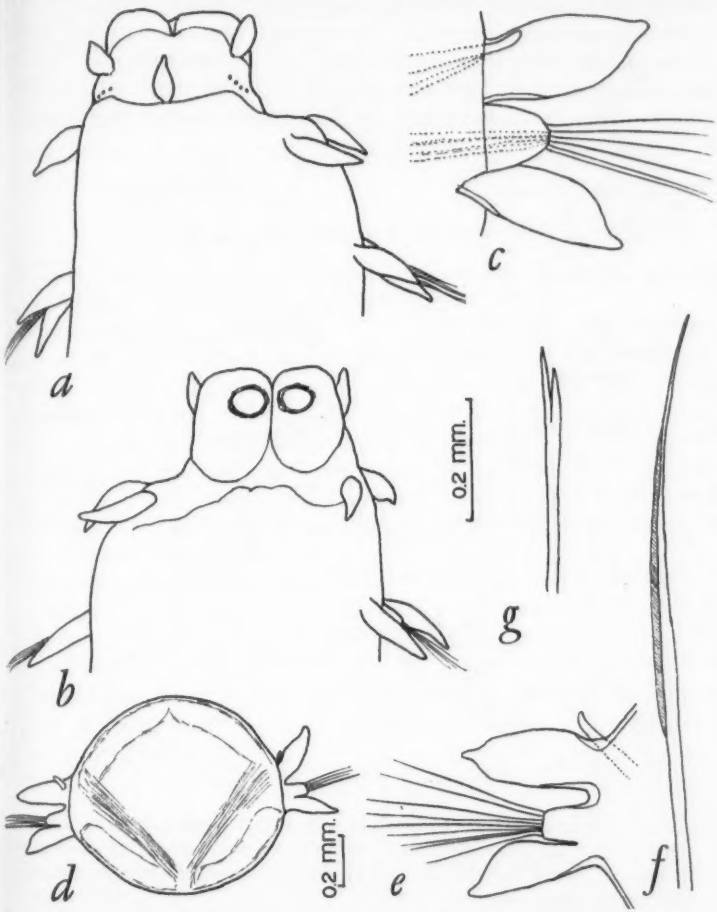

FIGURE 20.—*Synelmis albini* (*a-b*, from specimen from Saipan; *c-g*, from specimen from Dry Tortugas, Fla.): *a*, dorsal view anterior end; *b*, ventral view same, the palpostyles retracted within palpophores; *c*, parapodium from setiger 50; *d*, outline of cross section near posterior end; *e*, parapodium from same, the thick cuticle shown; *f*, neuroseta; *g*, forked neuroseta.

with pair of posterior eyes, each 2–4 contiguous spots. Tentacular segment prominent, overhanging prostomium and forming ventral lip, achaetous, with 2 pairs of subequal tentacular cirri. Dorsal cirri of

first setiger similar to following. Parapodia subbiramous, with dorsal and ventral cirri subequal, subulate to oval with acuminate tips. Notopodia with 1–2 notoacicula and stout, emergent, straight or slightly bent, acicular notosetae, beginning on setiger 5–20 (difficult to detect, not emergent at first). Neuropodia short, cylindrical, with 3 neuroacicula and bundle of neurosetae. Neurosetae limbate, tapering to capillary tips, limbate part sometimes appearing frayed or finely spinous (they break easily and the shorter broken setae may appear to

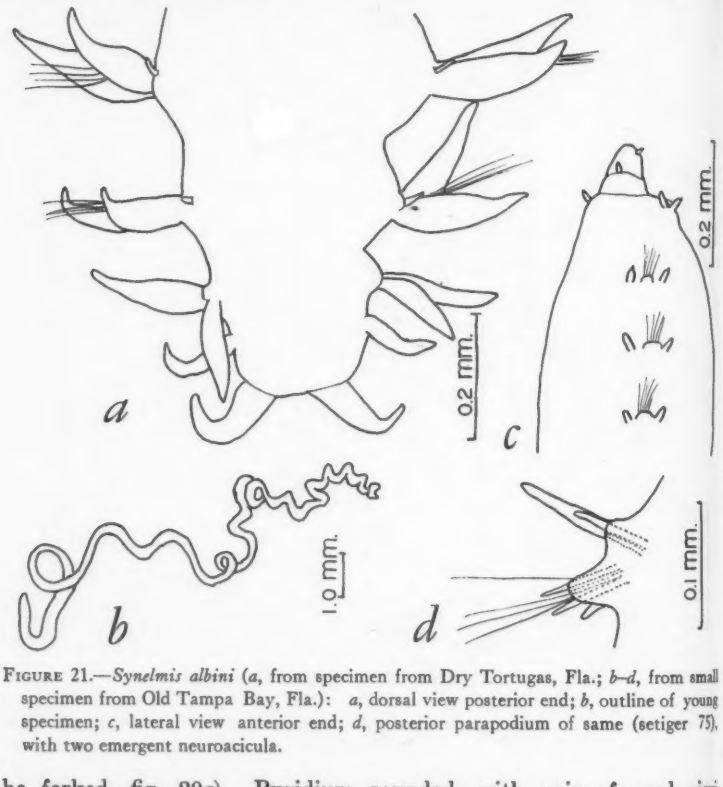

FIGURE 21.—*Synelmis albini* (*a*, from specimen from Dry Tortugas, Fla.; *b–d*, from small specimen from Old Tampa Bay, Fla.): *a*, dorsal view posterior end; *b*, outline of young specimen; *c*, lateral view anterior end; *d*, posterior parapodium of same (setiger 75), with two emergent neuroacicula.

be forked, fig. 20*g*). Pygidium rounded, with pair of anal cirri similar to dorsal and ventral cirri. Proboscis long, cylindrical, muscular, without papillae. Without intestinal caeca. Extra well-developed, dorsolateral and ventrolateral longitudinal muscles and diagonal muscles (figs. 19*c*; 20*d*). Integument with thick, smooth, iridescent cuticle extending on bases of dorsal and ventral cirri, without papillae. Color (preserved): yellowish to reddish, dark brown, iridescent, with reddish glandular areas at bases of parapodia.

Small specimens from Old Tampa Bay, Fla. (86 segments, 22 mm. long, 0.3 mm. wide, figs. 21*b-d*) showed the dorsal cirri longer, digitiform; neuropodia with 3 acicula, 2 of which project beyond setal lobe, with slender capillary neurosetae.

Distribution: Widespread in tropical and subtropical waters. North Pacific (off Japan, southern to Lower California, Panama), Central and South Pacific (Marshall Islands, Tuamotu Islands, Gambier Islands), Red Sea, Indian Ocean, North Atlantic (Canary Islands, West Indies) Gulf of Mexico (Florida, Dry Tortugas). Intertidal to 1388 fms.

Genus *Harpochaeta* Korschelt, 1893

Harpochaeta Korschelt, 1893. [Type-species: *H. cingulata* Korschelt, 1893, by monotypy. Trieste, Italy, in plankton. Gender: feminine.]

Diagnosis: Body elongated, with segmentation well marked. Prostomium rounded, with paired ventral palpostyles, 3 antennae and 2 eyes. Tentacular segment with 2 pairs of tentacular cirri. Parapodia subbiramous. Notopodia with dorsal cirri and emergent, notopodial, hooked setae beginning at about setiger 5. Neuropodia conical, with capillary, simple neurosetae, with ventral cirri. Tentacular, dorsal and ventral cirri jointed. Pair of short anal cirri. Larval organs consisting of prototroch, telotroch, larval organs in prostomium and pygidium.

Remarks: *Harpochaeta* has been referred by some authors to *Ancistrosyllis*. However until the adult of the only known species, *H. cingulata*, has been identified, it is difficult to know to what genus *Harpochaeta* should be referred. Of the known genera, it might be referred to *Sigambra* Müller, 1858, *Ancistrosyllis* McIntosh, 1879, or *Cabira* Webster, 1879.

Genus *Loandalia* Monro, 1963

Loandalia Monro, 1936. [Type-species: *L. aberrans* Monro, 1936, p. 193, by monotypy. Gender: feminine.]

?*Hermundura* Müller, 1858. [Type-species: *H. tricuspis* Müller, 1858, p. 216, by monotypy. Gender: feminine. Brazil.]

?*Telehsapia* Fauvel, 1932. [Type-species: *T. annandalei* Fauvel, 1932, p. 251, by monotypy. Gender: feminine. Gulf of Siam.]

Diagnosis: Body long, slender, subcylindrical, tapering posteriorly; anterior region (first 5–10 setigers) inflated to form a "thorax," with conical parapodia projecting from body (not deeply cut). Prostomium very reduced, inconspicuous, with reduced biarticulate palps, without antennae. Tentacular segment achaetous, without tentacular cirri. Parapodia subbiramous. Notopodia low or absent, with projecting stout notoacicula, with few additional slender

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notosetae. Without dorsal cirri. Neuropodia conical, with small, terminal neuropodial cirri, or "ventral cirri" (not in usual position for ventral cirri), with neuroacicula and neurosetae. Neurosetae simple, geniculate, or curved, with expanded blades and numerous transverse rows of teeth. Pygidial lobe rounded or concave platelike, with 3 small cirri, a lateral pair and midventral one. Proboscis unarmed, long, muscular, subclavate, with circlet of papillae around opening. Without intestinal caeca. Integument smooth or areolated (not papillated).

The following species have been referred previously to *Loandalia* Monro:

L. aberrans Monro, 1936, p. 193. Angola, South West Africa.

L. fauveli Berkeley and Berkeley, 1941, p. 30. Southern California. See below.

L. americana Hartman, 1947, p. 506. Gulf of Mexico, Southern California. Referred to *L. fauveli*, see below.

L. gracilis Hartmann-Schröder, 1959, p. 112. El Salvador, Central America. Referred to *L. fauveli*, see below.

L. capensis Day, 1963, p. 396. South Africa. Referred to *Cabira*, see page 178.

L. indica Thomas, 1963, p. 29. Arabian Sea. Questionable species (the part described as an anterior end appears to be a broken fragment).

Key to the Species of *Loandalia*

1. With ventral filiform branchiae beginning about setiger 54.
L. aberrans Monro

Without ventral filiform branchiae . . . **L. fauveli** Berkeley and Berkeley

Loandalia fauveli Berkeley and Berkeley

FIGURES 22, 23

Loandalia fauveli Berkeley and Berkeley, 1941, p. 30, figs. 4–6.—Hartman, 1960, p. 89.

Loandalia americana Hartman, 1947, p. 506, pl. 63, figs. 1–7; 1951, p. 39, pl. 12, figs. 1–3.

Loandalia gracilis Hartmann-Schröder, 1959, p. 112, figs. 51–57 (young?).

Material examined: Holotype of *L. fauveli* from southern California, loan from Cyril Berkeley. Two paratypes of *L. americana* from Biloxi, Miss., loan from Olga Hartman (AHF). Gulf County, Cape San Blas, Fla.; Suwannee, Dixie County, Fla.; Keaton Beach, Taylor County, Fla.; near Lynn Haven, Bay County, Fla., subtidal grass flats, loan from Meredith Jones (AMNH). Pensacola, Fla., 1885. Boat dredge in Mississippi Sound, 9 miles off Bayou, February 1898. Davis Bay, Miss., 1949, brackish water.

Description: Length to 125 mm., width to 3.3 mm., segments to 300. Body subcylindrical with inflated anterior region of 5 or so setigers (this region may be areolated, especially in larger specimens). Prosto-

mium small, inconspicuous, subtriangular, with palpophores indistinct from rest of prostomium, with small knoblike palpostyles which may be partially telescoped within palpophores. Small notopodia begin-

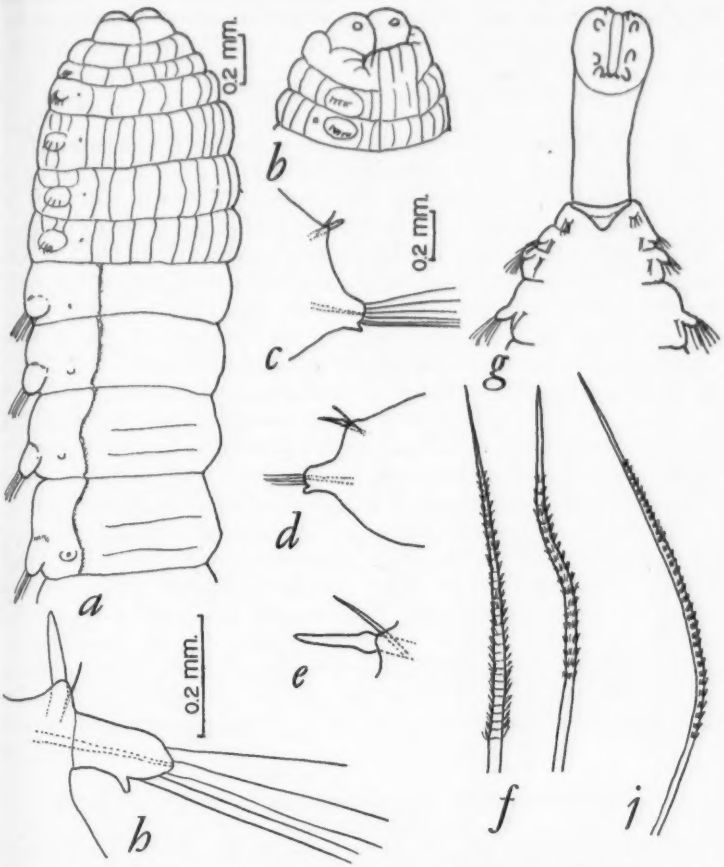

FIGURE 22.—*Loandalia fauveli* (*a–f*, from holotype of *L. fauveli*; *g*, from paratype of *L. americana*, large specimen; *h*, *i*, from small specimen of *L. fauveli* from Bay County, Fla.): *a*, dorsolateral view anterior end; *b*, ventrolateral view anterior end; *c*, parapodium from middle region; *d*, same, from posterior end; *e*, notopodium, enlarged; *f*, neurosetae; *g*, dorsal view anterior end, with proboscis extended; *h*, parapodium; *i*, neuroseta.

ning on setiger 2 (may be inconspicuous and easily overlooked in anterior areolated region of larger specimens; overlooked by Berkeley for *L. fauveli*); notopodia consisting of slightly projecting lobe with stout crystal-clear notoaciculum; tips of notoacicula projecting from

about setiger 8 (larger specimens) to 40 (smaller specimens) on; with additional slender notosetae, 2–3 in number (anterior 7 or so setigers) or 1–0. Neuropodia cylindro-conical with small "ventral cirri" on ventral side of distal ends, with moderate number of neurosetae (to about 15). Neurosetae simple, geniculate or curved, tapering to fine

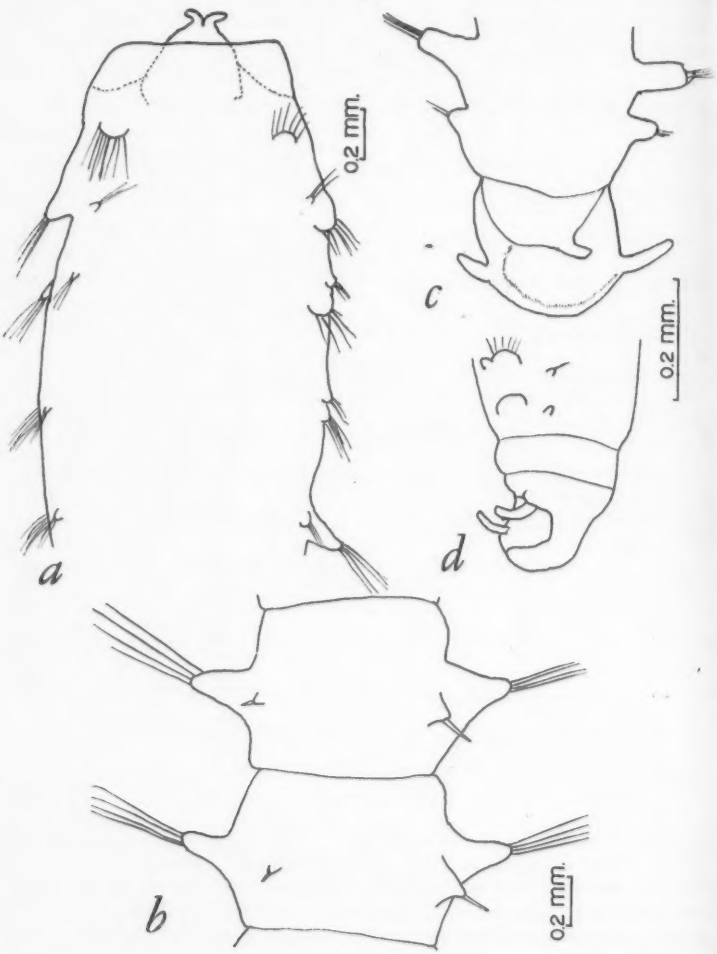

FIGURE 23.—*Loandalia fauveli* (from paratype of *L. americana*, small specimen): *a*, dorsal view anterior end with prostomium partially retracted within tentacular segment; *b*, two segments from posterior third, dorsal view; *c*, ventral view posterior end; *d*, lateral view posterior end.

tips, with numerous transverse spinous rows. Pygidium a rounded anal plate, concave ventrally, with pair of lateral cirri and midventral one. Proboscis long, subcylindrical, clavate, with circlet of 8 large papillae. Without intestinal caeca.

Distribution: Southern California, Central America, Gulf of Mexico (Florida, Mississippi, Louisiana). In low water to 625 fms.

Family Polynoidae

The pelagic polynoid upon which this part of the study was based is the holotype of *Ancistrosyllis longicirrata*, taken from the plankton off Peru and reported by Berkeley and Berkeley in 1961, with the suggestion that it might be a juvenile of a bottom-living form. They erroneously put it with the pilargids rather than with the polynoids. Mr. Cyril Berkeley very kindly sent me the holotype and has allowed me to study it and make additions and corrections to the original description. It can be referred to *Podarmus ploa* Chamberlin, a pelagic form described from off Easter Island in the South Pacific. The holotype of the latter species is in the U.S. National Museum but it is in very poor condition, being dark, brittle, and covered with crystals, making it difficult to study many of the structures; according to the original description by Chamberlin, it had been fixed in Fleming's fluid, causing a blackening of the tissues. Coloration and the poor condition of the specimen could account for Chamberlin's failure to mention some features. The elytra are missing on the specimens from both collections. Both are probably juveniles and not fully developed (30 segments, 14 pairs elytrophores for *P. ploa;* 35 segments, 16 pairs elytrophores for *A longicirrata*). *Podarmus atlanticus* Monro is herein referred to *P. ploa* since the setal differences indicated by Monro appear to be within the range of variation for the species; the specimen was perhaps fully developed (45 segments, 18 pairs elytrophores).

Genus *Podarmus* Chamberlin, 1919, emended

Podarmus Chamberlin, 1919. [Type-species: *P. ploa* Chamberlin, 1919, by original designation and monotypy. Gender: masculine.]

Diagnosis: Colorless and transparent, pelagic. Body short, tapering posteriorly, composed of relatively few segments (30–45). Prostomium bilobed, rounded, without cephalic peaks; 3 long antennae with ceratophores distinct, median antenna inserted in anterior notch, lateral antennae inserted slightly ventrally (subterminally, not lepidonotoid or halosydnoid), with paired palps. Tentacular segment achaetous, with 2 pairs of long tentacular cirri. With pair of long ventral cirri or buccal cirri on segment 2 (first setigerous). Parapodia

subbiramous. Notopodia small, with notoacicula only. Neuropodia elongated, with presetal and postsetal lips. Neurosetae of 2 kinds: 1) long, slender, with coarse serrations basally, with capillary tips; 2) shorter, with few serrations and slightly hooked tips. Elytral pairs 14–18 (often missing); elytrophores on segments 2, 4, 5, 7, 9, 11, 13, 15, 17, 19, 21, 23, 26, 29 (14 pairs, as in holotype *P. ploa*), 32, 35 (16 pairs, as in holotype *A. longicirrata*), 38?, 41? (18 pairs, as in *P. atlanticus;* exact arrangement not stated). Dorsal cirri on non-elytra-bearing segments long, tapered. Ventral cirri short, tapered. Pair of long anal cirri. Pharynx of usual polynoid type, with jaws and circlet of 18 papillae. With clavate glandular processes at bases of ventral cirri and at ventral bases of parapodia; with row of glandular prominences on ventroposterior borders of neuropodia and large glandular structures in upper part of neuropodia.

Podarmus ploa Chamberlin

FIGURES 24–26

Podarmus ploa Chamberlin, 1919, p. 46, pl. 6, fig. 6, pl. 7, figs. 1, 2.
Podarmus atlanticus Monro, 1930, p. 42, fig. 7.—Støp-Bowitz, 1948, p. 13, fig. 9.
Ancistrosyllis longicirrata Berkeley and Berkeley, 1961, p. 658, figs. 5–7.

Material examined: Holotype of *Podarmus ploa* from off Easter Island, South Pacific, from plankton (USNM 19458). Holotype of *Ancistrosyllis longicirrata* Berkeley and Berkeley from off Peru, South Pacific, from plankton (loan from Cyril Berkeley, now deposited in USNM 30990).

Description: Length to 13 mm., width including setae to 4 mm., segments to 45. Body widest toward anterior region, tapered anteriorly and posteriorly, convex dorsally, flattened ventrally, with parapodia very long, length exceeding width of body. Transparent. Prostomium bilobed, rounded anteriorly, without cephalic peaks. Median antenna with ceratophore in anterior notch, with style long, slender, tapering, smooth; lateral antennae with ceratophores at nearly same level as median antenna but inserted slightly ventrally, with styles similar to but shorter than median antenna; with pair of thick, contractile, tapering palps (thus variable in length), with pair of glandular clavate processes below palps; with 2 pairs of light-colored eyes, anterior pair lateral in position, posterior pair posterodorsal. Tentacular segment achaetous, lateral to prostomium, with 2 pairs of tentacular cirri on distinct ceratophores, lower pair similar to medium antenna, upper pair longer. First setigerous segment (segment 2 or buccal segment) with first pair of elytrophores and middorsal semicircular flap extending on posterior part of prostomium; ventrally it forms posterior lip of mouth, with extra long ventral cirri

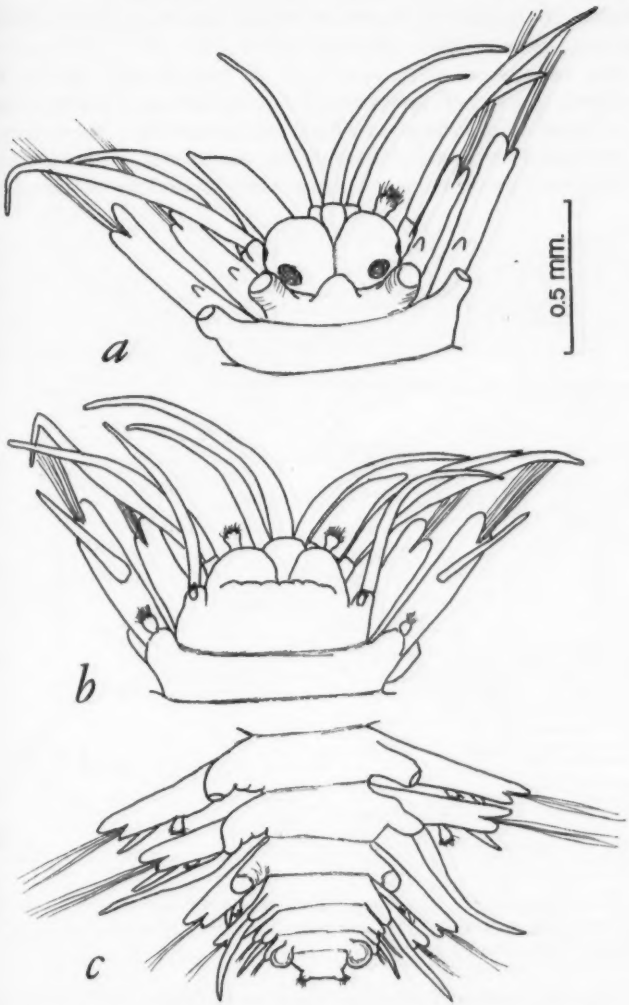

FIGURE 24.—*Podarmus ploa* (from holotype of *Ancistrosyllis longicirrata*): *a*, dorsal view prostomium and first 3 segments, elytra, dorsal cirri, and right palp missing; *b*, same, ventral view; *c*, dorsal view posterior end (segments 30–35), first dorsal cirri, elytra on segments 32 and 35, and anal cirri missing.

(buccal cirri) similar to lateral antennae and with oval glandular organs on ventral sides of cirrophores.

Elytra usually missing; according to Støp-Bowitz, rather large, translucent, with small warty papillae; elytrophores cylindrical, up to 18 pairs when fully formed, arranged as indicated in generic diagnosis. Dorsal cirri with cylindrical cirrophores; styles long, tapering, smooth, extending to tips of setae. Ventral cirri in middle of neuropodial

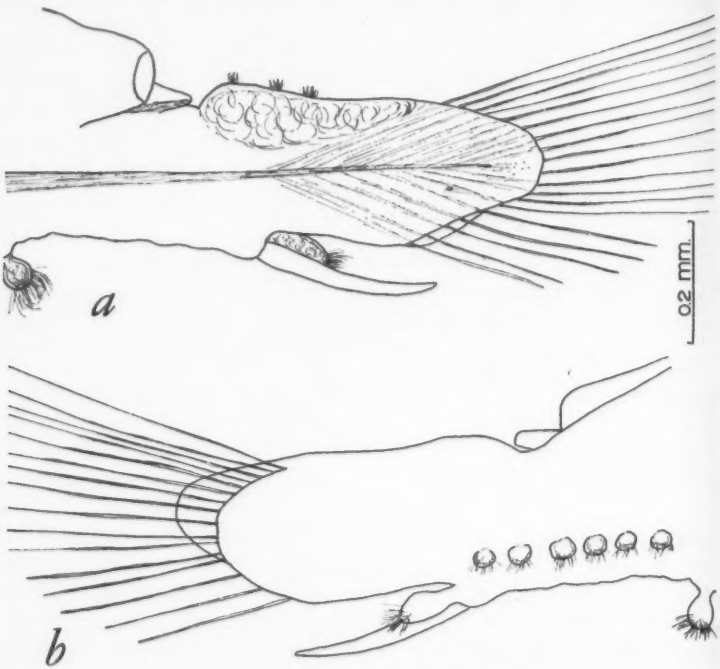

FIGURE 25.—*Podarmus ploa*: *a*, middle parapodium of cirrigerous segment, anterior view, style of dorsal cirrus missing (tips of neurosetae not shown; acicula and glandular areas indicated); *b*, same, posterior view.

lobes, tapering, smooth, shorter than setal lobes. Parapodia subbiramous; notopodia short, conical, on anterodorsal side of neuropodia, with notoacicula only, without notosetae. Neuropodial lobe elongated, flattened anteroposteriorly, split terminally into longer presetal and shorter postsetal lips, with elongated inflated glandular areas distal to notopodial lobe, with stout neuroaciculum extending into postsetal lip, with fan-shaped bundle of neurosetae. Neurosetae of 2 kinds: lower ones shorter, stouter, with a few heavy widely spaced spinous rows (3–4), with tips slightly hooked, sometimes

slightly bidentate; middle and upper setae more slender, enlarged basal parts with few heavier spinous rows and low ridges, with terminal whiplike tips.

Parapodial glandular structures present, containing large cells and giving off material having appearance of long cilia when preserved (fig. 25*a*): (1), large stalked papillae posterior to bases of ven-

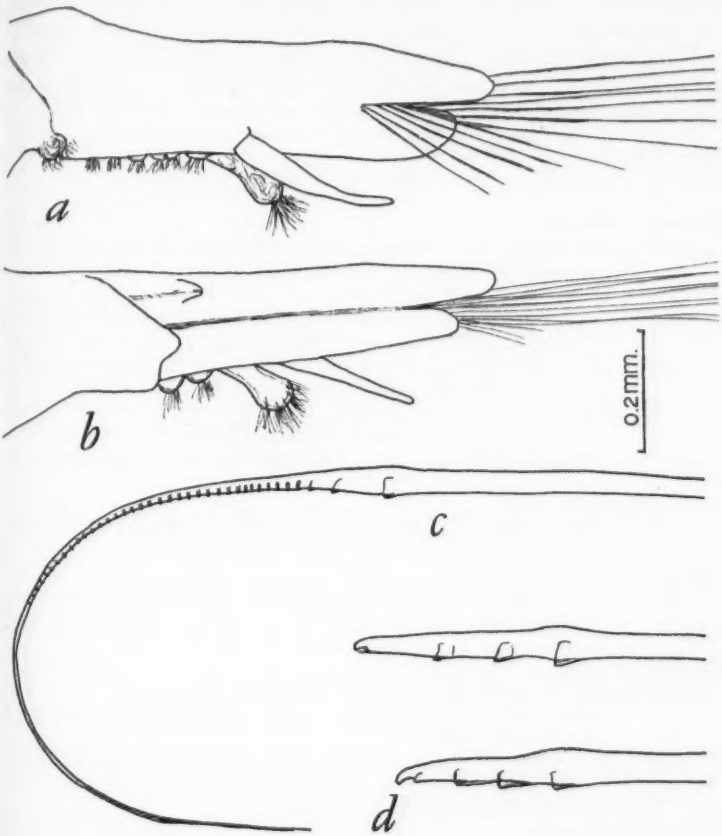

FIGURE 26.—*Podarmus ploa*: *a*, middle parapodium of cirrigerous segment, ventral view (tips of neurosetae not shown); *b*, same, dorsal view, style of dorsal cirrus missing (acicula indicated); *c*, upper neuroseta; *d*, lower neurosetae.

tral cirri, beginning on setiger 4–5 and continuing posteriorly (= cylindrical processes, Chamberlin; =clavate processes or enlarged genito-nephridial papillae, Monro; =stalked ciliated papillae, Berkeley); (2) smaller oval papillae on ventral basal parts of parapodia on

all setigers, below palps, and lateral to anal cirri; (3) row of circular areas (about 6) on posteroventral sides of parapodia between bases of ventral cirri and bases of parapodia (= row of ciliated prominences, Berkeley); (4) elongated areas in dorsal part of neuropodia distal to notopodia (= possibly ovarium, Støp-Bowitz).

Pydigium rounded, with pair of long anal cirri and pair of rounded glandular lobes lateral to cirri. Pharynx well developed, muscular, cylindrical, with jaws and circlet of 18 terminal papillae (Støp-Bowitz).

Distribution: South Pacific (off Easter Island, off Peru), South Atlantic (Gulf of Guinea off West Africa), North Atlantic (Sargasso Sea). In plankton, surface to 222 fms.

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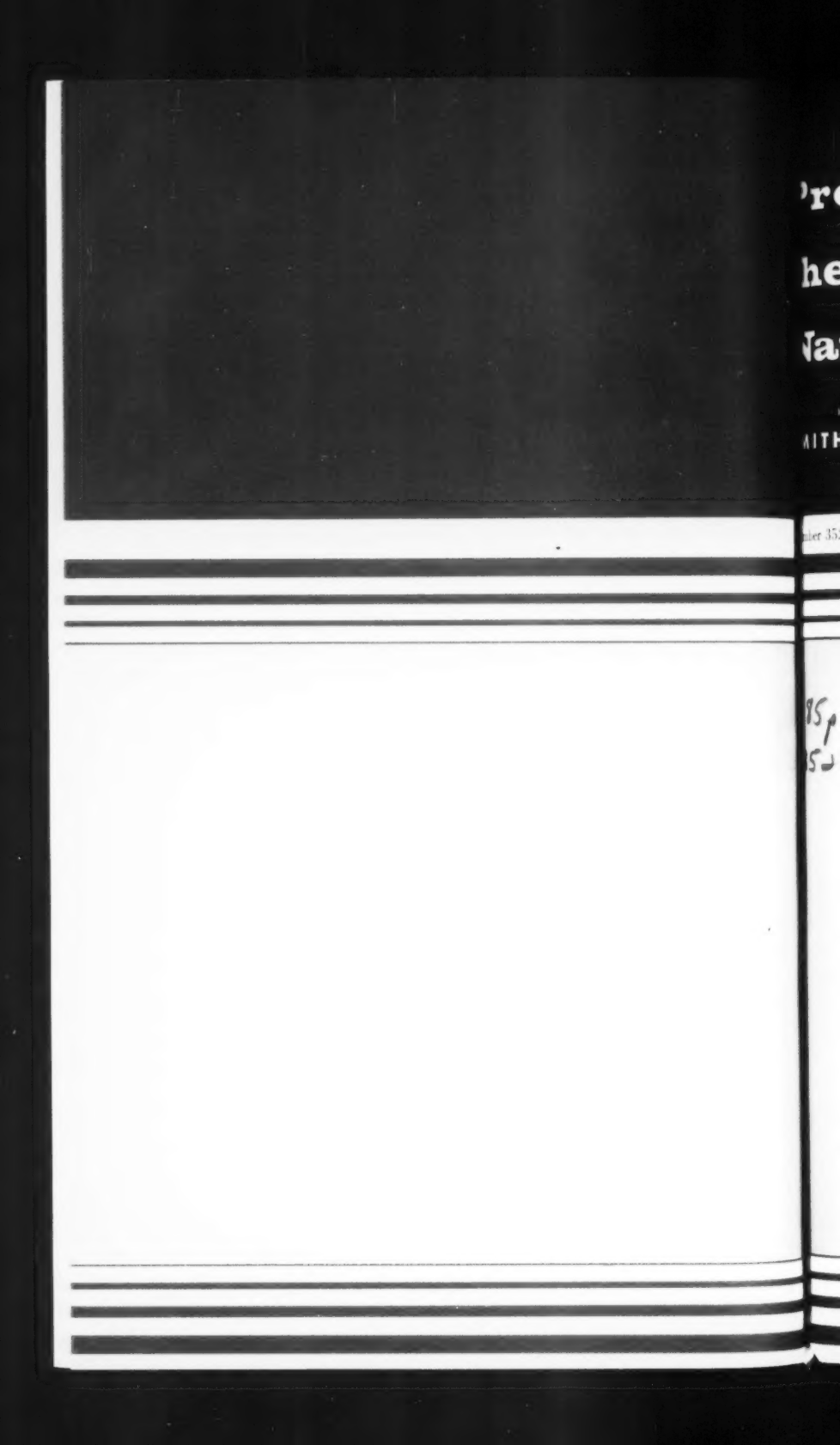

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DESCRIPTIONS AND RECORDS OF WEST INDIAN CERAMBYCIDAE (COLEOPTERA)

By JOHN A. CHEMSAK

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DESCRIPTIONS AND RECORDS OF WEST INDIAN CERAMBYCIDAE (COLEOPTERA)

By JOHN A. CHEMSAK[1]

This paper is intended primarily to report on a collection of Cerambycidae made by Dr. J. F. Gates Clarke, Chairman of the Department of Entomology, U.S. National Museum, while a member of the Smithsonian-Bredin Caribbean Expeditions to the British Virgin Islands and British West Indies in 1956 and 1958. A total of 136 Cerambycidae representing 13 genera and 21 species was taken on these faunistically interesting islands. Of these, six are presumed to be new and one previously described is considered to belong to a new genus.

A second objective is to contribute further to the knowledge of the cerambycid fauna of the West Indies. Although no major monograph covering this area as a whole has yet been published, a number of papers dealing with island groups or reporting new species have been published. Subsequent to 1862 when Chevrolat described several of the Cuban species, the major works have been those of Gahan (1895)

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and Fisher (1925, 1926, 1932, 1935a, 1935b, 1941, 1942, and 1947). The most recent contribution has been that of Cazier and Lacey (1952) dealing with the Bahama Islands.

The author is grateful to Dr. Clarke for the opportunity to study his material and to Professor E. G. Linsley for his assistance. This project was undertaken during the course of a National Science Foundation sponsored study on North American Cerambycidae (Grant GB–2326).

Types of new species are deposited in the collection of the U.S. National Museum.

Subfamily Cerambycinae

Tribe Methiini

Methia insularum, new species

Male: Form slender, short; elytra pale brownish testaceous; appendages darker; head, prothorax, and underside brownish to reddish piceous; pubescence pale, sparse, short, distinct. Head wider than pronotum; eyes separated on vertex by about diameter of third antennal segment or less, separated beneath by a distance subequal to diameter of antennal scape, upper and lower lobes connected by a single row of facets; antennae extending about five segments beyond body, scape with apical tooth small, erect hairs along outside margin of segments shorter than diameter of segments, internal cilia dense, suberect, slightly longer on the basal segments than the erect outside hairs. Pronotum broader than long, sides rounded, base strongly constricted, transverse impression not extending across disc, apex feebly constricted and impressed; disc scabrous, punctures shallow, vague, central area flattened, with a round, glabrous, depressed callus at middle near base and two indistinct, raised calluses at basal margin; pubescence sparse, long, subdepressed; stridulatory plate of mesonotum not grooved; prosternum convex; episternum of metathorax scabrous, opaque. Elytra about twice as long as broad, extending to fourth abdominal segment; each elytron with a distinct median costa; punctures dense, fine, confluent, shallow; pubescence rather dense, short, recurved. Legs moderately densely pubescent, femora scabrous. Abdomen sparsely punctate and pubescent; apex of last sternite emarginate truncate. Length 4–6 mm.

Female: Slightly larger, more elongate; color usually paler with head and prothorax orangish brown; antennae extending about four segments beyond body, segments clothed with short suberect hairs; elytral apices narrowly round; apex of last abdominal sternite deeply emarginate, V-shaped. Length 4–7.5 mm.

Holotype male (USNM 68224), allotype female, and 10 paratypes (2 ♂♂, 8 ♀♀) from Prickly Pear Isl., Vixen Point, Virgin Gorda, B.V.I., Apr. 14, 1956, and Apr. 6, 1958 (J. F. G. Clarke); additional specimens not designated as paratypes include: 2 ♂♂, Francis Bay, Saint Johns, A.V.I., Mar. 25, 1958.

The elytra of this species are pale with a little infuscation often present at the base. *M. insularum* differs from *M. necydalea* (Fabricius) by the usually concolorous elytra, narrower elytral apices, shorter pubescence of the antennal segments, and almost impunctate pronotal disc. From *M. pallida* Fisher, it may be distinguished by having the lobes of the eyes connected by a single row of facets.

***Methia impressicollis*, new species**

Female: Form slender, small; color brownish testaceous; elytra slightly paler; pubescence pale, sparse, short. Head slightly wider than pronotum; eyes separated on vertex by less than diameter of third antennal segment, separated beneath by a distance greater than diameter of antennal scape, upper and lower lobes connected by a single row of facets; antennae extending about four segments beyond body, scape with strong apical tooth, segments densely clothed with short suberect hairs along outside margin, suberect hairs of inside margin longer. Pronotum broader than long, sides rounded, base strongly constricted and broadly, deeply impressed transversely, apex less strongly constricted, shallowly impressed; disc slightly concave with an impressed, subglabrous, V-shaped area at middle beginning near basal margin, surface scabrous, punctures fine, vague; pubescence fine, mostly subdepressed; stridulatory plate of mesonotum not grooved; prosternum narrowly impressed; episternum of metathorax opaque. Elytra over 2½ times as long as broad, extending to about fourth abdominal segment; costae vague, punctures fine, shallow, irregular, somewhat rugulose; pubescence very short, erect. Legs with femora minutely rugulose, sparsely pubescent. Abdomen with last sternite deeply V-shaped emarginate at apex. Length 5 mm.

Holotype female (USNM 67325) from Little Harbor, Jost Van Dyke, B.V.I., Apr. 1, 1958 (J. F. G. Clarke).

This species differs from the other known West Indian *Methia* by the V-shaped impression of the pronotum.

Tribe Achrysonini

***Achryson surinamum* (Linnaeus)**

Cerambyx surinamus Linnaeus, 1767, p. 632.
Achryson surinamum.—White, 1855, p. 298.

Two ♀♀, Saint Ann's Hill, Antigua, B.W.I., Apr. 19, 21, 1958.

For a synonymical bibliography of this species, see Linsley, 1962.

Tribe Hesperophanini

Eburia decemmaculata (Fabricius)

Stenocorus 10-maculatus Fabricius, 1775, p. 181.
Eburia decemmaculata.—White, 1855, p. 91.

One ♀, English Harbor, Antigua, B.W.I., Apr. 20, 1958.

Eburia quadrimaculata (Linnaeus)

Cerambyx 4-maculatus Linnaeus, 1767, p. 626.
Eburia quadrimaculata.—Audinet-Serville, 1834, p. 9.

Three ♂♂, Sopers Hole, Tortola, B.V.I., Apr. 5, 1958.

Tribe Elaphidionini

Elaphidion glabratum (Fabricius)

Stenocorus glabratus Fabricius, 1792, p. 295.
Elaphidion glabratum.—Newman, 1840, p. 27.

One ♂, Sopers Hole, Tortola, B.V.I., Apr. 5, 1958.

Elaphidion insulare Newman

Elaphidion insulare Newman, 1840, p. 27.

One ♀, Mount Sage, 1000′, Tortola, B.V.I., Apr. 17, 1956; 2 ♀♀, Sopers Hole, Tortola, B.V.I., Apr. 5, 1958; 1 ♂, Prickly Pear Isl., Vixen Point, Virgin Gorda, B.V.I., Apr. 6, 1958.

Elaphidionoides thomae (Gahan)

Elaphidion thomae Gahan, 1895, p. 104.

Fourteen ♂♂, 13 ♀♀, Prickly Pear Isl., Vixen Point, Virgin Gorda, B.V.I. Apr. 6, 1958; 18 ♂♂, 12 ♀♀, Sopers Hole, Tortola, B.V.I., Apr. 5, 1958; 1 ♀, Sopers Hole, Mar. 31, 1958; 1 ♀, Francis Bay, Saint Johns, A.V.I., Mar. 25, 1958.

Curtomerus flavus (Fabricius)

Callidium flavum Fabricius, 1775, p. 191.
Cylindera flava.—Aurivillius 1912, p. 120.
Curtomerus flavus.—Gressitt, 1956, p. 77.

Three ♂♂, 3 ♀♀, Prickly Pear Isl., Vixen Point, Virgin Gorda, B.V.I., Apr. 14, 1956, Apr. 6, 1958; 1 ♀, No. of Road Bay, 200′, Anguilla, B.W.I., Apr. 12, 1958; 1 ♂, Flat Top Point, Anguilla, B.W.I., Apr. 13, 1958; 1 ♂, 1 ♀, Oyster Pond, Barbuda, B.W.I., Apr. 6, 1956.

A complete synonymical bibliography for this species can be found in Linsley, 1963.

***Curtomerus subflavus*, new species**

Male: Form robust, somewhat depressed; color uniformly brownish testaceous, appendages slightly paler; pubescence golden, moderately dense. Head finely, shallowly, confluently punctate on vertex and front, area between prominent antennal tubercles shallowly concave, median line not deep; erect, stiff setae numerous around mouthparts, pubescence sparse, short, subdepressed and suberect elsewhere; antennae extending about two segments beyond elytra, segments from second densely clothed with very short, appressed pubescence, long erect hairs dense along inside margin, long hairs also numerous at outside margin of basal segments, scape shining, finely densely punctate, sparsely clothed with long, suberect and short, appressed hairs, third segment slightly longer than scape, fourth subequal to scape, fifth longer than third, eleventh longer than tenth. Pronotum about as long as broad, sides rounded, base deeply constricted, impressed at sides, apex feebly constricted, not impressed; disc flattened, with a median, longitudinal, nonelevated, glabrous callus; punctures around median callus coarse, confluent, rugose appearing from basal margin to apical one-third of disc, punctures finer and separated toward apex, sides at apex and base very sparsely punctate; each puncture giving rise to a long, suberect, yellowish hair; prosternum not impressed, with distinctly delimited, densely punctate areas extending from sides of pronotum to narrow, glabrous, central area which joins the transversely impressed collar, pubescence sparse; meso- and metasternum sparsely punctate and pubescent; scutellum small, subglabrous. Elytra less than 2½ times as long as broad; basal punctures finer than those of pronotal disc, separated, becoming finer and sparser only at extreme apex; pubescence consisting of long suberect, recurved hairs, each arising out of a puncture; each elytron strongly bicostate; apices rounded. Legs with femora strongly clavate, minutely punctate, pubescence long, suberect and short, appressed. Abdomen shining, very sparsely punctate and pubescent; apex of last sternite rounded. Length 12 mm.

Female: Antennae slightly shorter than body; prosternum shining, very sparsely punctate, shallowly rugulose; apex of last abdominal sternite subtruncate. Length 9–10 mm.

Holotype male (USNM 67326), allotype female from Flat Top Point, Anguilla, B.W.I., Apr. 13, 1958 (J. F. G. Clarke); one female paratype from Sopers Hole, Tortola, B.V.I., Apr. 5, 1958.

The coarse, confluent punctures surrounding the median glabrous callus of the pronotum will distinguish *C. subflavus* from the other known *Curtomerus*.

Nesanoplium, new genus

Body small, parallel-sided, clothed with short subdepressed, recurved hairs intermixed with longer, erect setae. Head flat between antennae, surface coarsely alveolate-punctate, median line vague; palpi subequal, apical segments securiform; eyes coarsely faceted, deeply emarginate; antennae about as long as body in males, shorter in females, segments carinate, three to seven spined at apex internally, segments six to nine spined externally, third segment distinctly longest, fourth shorter than fifth, fifth to ninth subequal, tenth shorter than eleventh, eleventh subequal to ninth. Pronotum rounded at sides; disc rather coarsely alveolate-punctate, without calluses; anterior coxal cavities open behind, prosternal process arcuately declivous behind, slightly expanded at apex; intermediate coxal cavities closed to epimeron; episternum of metathorax slender, narrowing slightly from base to apex. Elytra subparallel; surface coarsely, closely punctate, sparsely at apex, costae vague; pubescence short, recurved, subdepressed with long erect hairs interspersed; apices spined at external angle, slightly dentate at suture. Legs with femora clavate, without apical spines; tibiae carinate.

Type species: *Cyrtomerus puberulus* Fleutiaux and Sallé.

This genus resembles *Elaphidionopsis* Linsley but differs by the spined antennal segments, spined elytral apices, and clavate femora. The armed antennae and elytra and deeply emarginate eyes separate it from *Curtomerus*, where the type species *C. puberulus* has previously been placed.

Nesanoplium puberulum (Fleutiaux and Sallé), new combination

Cyrtomerus puberulus Fleutiaux and Sallé, 1889, p. 464, pl. 8, fig. 17.
Cylindera (?) *puberula.*—Gahan, 1895, p. 108.
Cylindera puberula.—Aurivillius, 1912, p. 120.

One ♂, 2 ♀♀, Sopers Hole, Tortola, B.V.I., Apr. 5, 1958.

Tribe Callidiopini

Merostenus attenuatus (Chevrolat)

Lampromerus (?) *attenuatus* Chevrolat, 1862, p. 263.
Merostenus attenuatus.—Gahan, 1895, p. 109.

One ♂, 1 ♀, Prickly Pear Isl., Vixen Point, Virgin Gorda, B.V.I., Apr. 14, 1956, Apr. 6, 1958; 6 ♂♂, Little Harbor, Jost Van Dyke, B.V.I., Apr. 1, 1958; 2 ♂♂, Sopers Hole, Tortola, B.V.I., Apr. 5, 1958,

Merostenus similis Fisher

Merostenus similis Fisher, 1932, p. 53.

One ♂, English Harbor, Antigua, B.W.I., Apr. 2, 1956; 1 ♂, Oyster Pond, Barbuda, B.W.I; Apr. 6, 1956.

Tribe Ibidionini

***Heterachthes quadrimaculatus* (Fabricius)**

Callidium 4-maculatum Fabricius, 1792, p. 328.
Heterachtes [sic] *quadrimaculatus.*—Aurivillius, 1912, p. 111.

There may be some doubt as to the correct determination of this species. The five specimens at hand have been compared with material in the U.S. National Museum identified as *quadrimaculata.* However, either two species are involved or a striking sexual dimorphism exists. The males are all densely pubescent with denuded areas containing a coarse puncture enclosing a long erect seta and the elytral apices are truncate and unarmed. In the females the dense pubescence is less pronounced and the elytral apices bear a stout spine at the external angle. Records include:

Two ♂♂, Brandywine Bay, Tortola, B.V.I., Mar. 21, 1958; 1 ♂, Sopers Hole, Tortola, Apr. 5, 1958; 1 ♀, Antrim, 1000′, Antigua, B.W.I., Mar. 14, 1958; 1 ♀, Oyster Bay, Barbuda, B.W.I., Apr. 6, 1956.

Tribe Anaglyptini

***Tilloclytus puertoricensis* Fisher**

Tilloclytus puertoricensis Fisher, 1935, p. 51.

One ♀, Francis Bay, Saint Johns, A.V.I., Mar. 25, 1958.

Subfamily Lamiinae

Tribe Ataxiini

***Ataxia alboscutellata* Fisher**

Ataxia alboscutellata Fisher, 1926, p. 3.

One ♀, Mount Sage, 1000′, Tortola, B.V.I., Apr. 17, 1956.

Tribe Acanthocinini

***Leptostylus testaceus* (Frölich)**

Cerambyx testaceus Frölich, 1792, p. 141.
Leptostylus testaceus.—Aurivillius, 1923, p. 403.

One ♂, Sopers Hole, Tortola, B.V.I., Apr. 5, 1958; 1 ♂, Little Bay, Peter Isl., B.V.I., Mar. 30, 1958.

***Leptostylus inflaticollis*, new species**

Male: Form short, robust, convex above; color pale reddish brown, densely clothed with whitish to brown appressed pubescence and ornamented with dark brown and black pubescent spots. Head with front nearly flat, subquadrate, deeply angularly depressed between

antennal tubercles, antennal tubercles strongly developed and divergent; punctation obscured, pubescence concealing surface, appressed, grayish and dark brown; narrow longitudinal line extending from epistoma to occiput; eyes small, moderately coarsely faceted, deeply emarginate, separated above by less than diameter of antennal scape; antennae extending about four segments beyond body, first four segments densely mottled with dark brown and pale gray-brown pubescence, the following segments pale gray brown with apices and bases dark brown, the dark brown banding increasing in width apically, scape extending to basal one-third of pronotum, subequal in length to fifth segment, fourth longer than fifth, third longer than fourth, eleventh segment slender, subequal to tenth. Pronotum more than 1½ times as broad as long, base broader than apex; sides rounded to basal margin, then strongly constricted, strongly inflated at sides to produce a very broad, obtuse tubercle; surface narrowly, shallowly impressed at apex, more deeply and broadly at base, disc almost flattened, without calluses, punctures not visible; pubescence dense, recumbent, pale gray brown to brown with a narrow dark-brown median vitta extending length of pronotum, two dark brown oblique bands at sides of median band in front of middle and two short dark-brown basal bands near lateral margins, small dark spots sparse at edges; prosternum very narrow, intercoxal process broad, expanded apically, coxal cavities closed; mesosternal process very broad, episternum of metathorax narrow, narrowing posteriorly; scutellum triangular, narrowly rounded behind, densely pubescent. Elytra over 1½ times longer than broad, slightly broader than pronotum; humeri not strongly developed; surface uneven, with subsutural costae extending from base to before apex, humeral costae extending obliquely to about basal one-third, then running parallel to subsutural ones, lateral costae arcuately joining others before apex with a vague short costa between lateral and humeral ones; punctures at base fine, separated, becoming coarser and denser at midelytra; pubescence dense, recumbent, grayish to brown with two dark elongate spots at middle of elytra just behind middle, an oblique, inverted V-shaped, short brown chevron at apical third extending from suture and darker irregular spots placed behind and toward the lateral margins, small black spots sparsely interspersed; apices obliquely truncate. Legs with femora strongly clavate, densely clothed with mottled pale and brown pubescence; tibiae with two broad dark bands at outside surface. Abdomen uniformly, moderately densely pale pubescent; apex of last sternite narrowly rounded. Length 7 mm.

Holotype male (USNM 67327) from Little Bay, Peter Isl., B.V.I., Mar. 30, 1958 (J. F. G. Clarke).

This species is distinctive by the strongly laterally inflated and noncallused disc of the pronotum.

***Leptostylus bredini*, new species**

Male: Form short, robust, slightly convex above; ground color reddish brown, appendages paler, densely clothed with pale brown recumbent pubescence and ornamented with dark brown and white spots and bands. Head with front flat, subquadrate, rather shallowly impressed between antennal tubercles, antennal tubercles elevated, divergent, not strong; punctation obscured, pubescence concealing surface, recumbent, mottled grayish and brown; narrow longitudinal line extending from epistoma to occiput; eyes small, moderately coarsely faceted, deeply emarginate, separated above by about diameter of antennal scape; mouthparts with long erect hairs; antennae about as long as body, first four segments densely mottled with dark brown and pale gray-brown pubescence, the following segments pale gray brown with dark bands at apices and bases, scape extending slightly beyond middle of pronotum, scape shorter than third segment, longer than remaining segments, segments from third gradually decreasing in length. Pronotum about 1½ times broader than long, base broader than apex; sides feebly inflated, somewhat rounded from apex to feeble basal constriction, apex and base shallowly impressed; surface distinctly, finely, separately punctate, disc with five feeble, barely elevated calluses; pubescence gray brown, mottled with dark brown, vittae absent; prosternum narrow, intercoxal process broad, apically expanded, coxal cavities closed; mesosternal process very broad, pubescence moderately dense; scutellum triangular, broadly rounded behind, densely pubescent. Elytra less than 1½ as long as broad, tapering apically, less than 1½ times as broad as pronotum, humeri feeble; surface uneven, vaguely costate with elevated dark-brown pubescent spots longitudinally arranged down costae; punctures fine, sparse; pubescence dense, recumbent, brownish except for elevated dark spots and irregular white streaks, suture narrowly white pubescent with narrow vague whitish bands beginning at suture a little behind middle and extending obliquely back toward lateral margins, sides with dark vittae extending from behind humeri obliquely back toward suture and angling toward lateral margin at about apical one-fourth, base behind scutellum with a narrow dark, slightly arcuate band not extending to lateral margins; apices narrow, obliquely truncate. Legs with femora strongly clavate, pubescence mottled pale and brown; tibiae with irregular dark bands. Abdomen moderately densely pale pubescent; apex of last sternite emarginate. Length 7–8 mm.

Female: Antennae slightly shorter than body; femora less strongly clavate; apex of last abdominal sternite shallowly emarginate truncate. Length 6–8 mm.

Holotype male (USNM 67328), allotype female, and 8 paratypes (2 ♂♂, 6 ♀♀) from English Harbor, Antigua, B.W.I., Apr. 2, 1956 (J. F. G. Clarke); also assigned to this species but not designated as paratypes are 2 ♂♂, 1 ♀, Saint Ann's Hill, Antigua, B.W.I., Apr. 21, 1958.

The exact relationships of this species are not known at this time but the species may be recognized by the feeble calluses of the pronotum and the arrangement of the pubescent pattern.

L. bredini is dedicated to J. Bruce Bredin, of Wilmington, Del., sponsor of the Smithsonian-Bredin expeditions to the Caribbean.

***Urgleptes clarkei*, new species**

Female: Form small, moderately depressed; integument dark to pale reddish brown, appendages brownish testaceous and piceous; pubescence short, recumbent, grayish with dark-brown mottling. Head with front nearly square, convex, feebly impressed between antennal tubercles, antennal tubercles slightly elevated, widely divergent; narrow median groove extending from epistoma to occiput; punctation minute, contiguous, scabrous; pubescence moderately dense, appressed, not obscuring surface; eyes small, coarsely faceted, deeply emarginate, separated above by much more than diameter of antennal scape; antennae extending about six segments beyond body, scape infuscated over apical half, remaining segments narrowly dark-banded at apex, pubescence moderately dense, minute, appressed, scape slightly shorter than third segment, fourth longer than third, fifth subequal to scape. Pronotum over 1½ times as broad as long, base narrower than apex; sides diverging slightly to apices of acute spines near base, base stongly constricted behind the feebly obliquely, outward extending spines; base slightly impressed, apex not; disc slightly convex, minutely, opaquely punctate except for row of coarse punctures along basal margins; pubescence moderately dense, appressed, grayish with darker hairs on middle of disc which form dark patches at sides of middle; pro- and mesosternal processes narrow, about one-fourth the width of the coxae; scutellum broadly rounded, moderately pubescent. Elytra less than twice as long as broad, wider than the pronotum, sides parallel to about apical one-fourth, then tapering to apex; surface feebly depressed at basal one-third, costae lacking; punctures moderately coarse, contiguous over entire surface; pubescence gray brown, mottled with brown near base and irregular dark spots at apical half, dark patches usually extending laterally behind humeri and obliquely onto disc a little behind middle, two

small spots near suture giving the overall effect of a dark, broken, irregular band, dark patches also irregularly placed behind the broken band; apices obliquely emarginate truncate. Legs with hind femora moderately clavate, irregularly infuscated over club, tibiae irregularly infuscated. Abdomen moderately pubescent; apex of last sternite narrowly rotundate truncate. Length 3.5–4 mm.

Holotype female (USNM 67329) and five female paratypes from Little Bay, Peter Isl., B.V.I., Mar. 30, 1958 (J. F. G. Clarke); two additional females not designated as paratypical from English Harbor, Antigua, B.W.I., Apr. 20, 1958 and Apr. 2, 1956.

This species varies in the amount of dark patches present on the elytra and in the infuscation of the pronotum and appendages. The dark patches are restricted to the apical half of the elytra when viewed from above.

Also tentatively assigned to *L. clarkei* is one female from Sopers Hole, Tortola, B.V.I., Apr. 5, 1958. This latter specimen is clothed with paler pubescence and the elytral apices are truncate. It may represent a distinct species but the lack of definitive series makes such an assignment impractical at this time.

U. clarkei is dedicated to J. F. G. Clarke, who made available for study the material reported in this paper.

Urgleptes species

One female from Antrim, 1000′, Dominica, B.W.I., Mar. 15, 1956, probably represents a new species, but I choose not to describe it at this time on the basis of a unique. This small (5.5 mm.) pretty specimen is rather pale with the elytra and appendages being dominantly testaceous. The head and pronotal disc are a pale reddish brown. The elytra are irregularly mottled by elongate patches of dark pubescence, the vague costae are clothed with very pale brown pubescence. The legs are almost all very pale with small dark spots on the club of the femora and the tibiae are apically infuscated.

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NEOTROPICAL MICROLEPIDOPTERA, VII

NEW GENUS *PSEUDOMERITASTIS* AND ITS SPECIES (LEPIDOPTERA: TORTRICIDAE)

By NICHOLAS S. OBRAZTSOV

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NEOTROPICAL MICROLEPIDOPTERA, VII

NEW GENUS *PSEUDOMERITASTIS* AND ITS SPECIES (LEPIDOPTERA: TORTRICIDAE)[1]

By NICHOLAS S. OBRAZTSOV[2]

Three species of the Tortricidae of the Neotropical fauna—*voluta* Meyrick, *cordigera* Walsingham, and *heliadelpha* Meyrick—were placed by Edward Meyrick in the genus *Meritastis* Meyrick, and *cordigera* was treated as a synonym of *voluta*. The present author had the opportunity to reexamine these species which he accepts; his review of the materials disclosed four undescribed species belonging in the same relationship. His studies have shown that *cordigera* is a separate species and that the entire group requires the recognition of a new genus, having little in common with *Meritastis*.

In this paper the author establishes the new genus, describes four new species, and gives information on the species formerly known. The author acknowledges with thanks the kind assistance of Dr. J. F.

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Pseudomeritastis, new genus

Meritastis (not Meyrick, 1910).—Meyrick [1912], Trans. Ent. Soc. London, 1911, p. 677 (*voluta* Meyrick); 1912, *in* Wagner, Lepidopterorum catalogus, pt. 10, p. 36 (*voluta*); 1913, *in* Wytsman, Genera insectorum, fasc. 149, p. 34 (*voluta*); 1932, Exotic Microlepidoptera, vol. 4, p. 261 (*heliadelpha* Meyrick).—Obraztsov, 1954, Tijdschr. Ent., vol. 97, p. 186 (*voluta*).—Clarke, 1955, Catalogue of the type specimens of Microlepidoptera in the British Museum described by Edward Meyrick, vol. 1, pp. 154, 326 (*heliadelpha*, *voluta*); 1958, op. cit., vol. 3, p. 156 (*voluta*).

Tortrix (in part).—Walsingham, 1914, *in* Godman and Salvin, Biologia Centrali-Americana, vol. 42 (Lepidoptera-Heterocera, vol. 4), p. 276 (*cordigera* Walsingham).

Type species: *Tortrix cordigera* Walsingham, 1914.

Head roughly scaled. Antenna in male slightly serrate, densely short ciliated; in female simple, with short setae. Labial palpus rather long, ascending, almost equally broad, scaling smooth; basal segment slightly dilated; second segment long; terminal segment thick, exposed. Ocellus absent. Proboscis well developed. Thorax with posterior crest more or less developed.

Forewing broad; costa arched; apex rotundate; termen straight, almost vertical; tornus broadly rounded; dorsum straight, gradually curved in basal portion. No costal fold in male. Twelve veins, all separate; vein S gently curved; R_1 from behind middle of discal cell; R_2 widely remote from R_1 and R_3, slightly more approximated to the latter; veins R_3 through M_1 almost equidistant at base; R_4 to apex; M_1 and M_2 widely separated, at termen slightly approximated to each other; upper internal vein (generally underdeveloped) originates between R_1 and R_2 and ends at R_5; veins M_2 through Cu_1 distinctly bent upwardly, at base almost as widely separated from each other as R_3 through M_1; Cu_1 originates slightly before lower angle of discal cell; Cu_2 distinctly from before two-thirds of discal cell, but always from behind its middle; A_1 in median portion generally indistinct; basal fork of A_{2+3} slightly shorter than one-third of entire vein.

Hindwing rotundate-subtrapezoidal, as broad as forewing or slightly narrower; costa gently arched; apex broadly rotundate; termen almost straight; tornus very flatly rounded; dorsum broadly rounded, in basal portion slightly sclerotized. Eight veins; S almost straight; R and M_1 closely parallel in basal portion, or stalked; M_1

strongly bent downwards to base; M_2, M_3, and Cu_1 close to each other at base, but distinctly separated; Cu_1 originates from lower angle of discal cell, Cu_2 from about two-thirds; A_1 very weak; A_2 with basal fork; A_3 weak. Discal cell somewhat widened in middle portion; cubitus without pecten; basal fork of A_2 with a brush of long hairs.

Male genitalia: Tegumen moderately broad, with oblique shoulders; pedunculi gradually narrowing ventrad; saccus complete, rounded. Valva elongate, in apical portion somewhat narrower than basally; costa narrowly sclerotized; sacculus well developed, represented by a long, sclerotized, longitudinal ledge ending with an acute projection protruding from ventral margin of valva; or this ledge is rather short, not protruding from valva and having a curved, longitudinal fold bearing a brush of long hairs; cucullus more or less haired. Uncus moderate to rather long, curved, with apex acute; or apex slightly bulbose, somewhat stronger sclerotized; or apex flatly spatulate. Gnathos with middle process more or less broad, spatulate, in some species with two acute lateral processes, one on each side of middle tip; arms of gnathos continued caudoventrad as more or less long, lateral appendices, densely clothed with setae at least in apical portions; socii more or less elongate, slightly dilated apically. Fultura superior shaped as a transverse, weakly sclerotized bar; fultura inferior broad, shield-shaped; caulis short. Aedeagus moderately long, more or less bent, strongly sclerotized, variously shaped; an elongate, stronger sclerotized carina penis, located laterally, dorso-apicad of caulis; vesica without armature.

Female genitalia: Papillae anales elongate, rather broad; apophyses posteriores about three times as long as apophyses anteriores. Two large, erectile sacs (?osmeteria), one on each side of postsegmental membrane of eighth segment. Ostium bursae very wide, located just caudad of seventh segment. Antrum broad, slightly infundibuliform, dilated caudally, receiving ductus seminalis cephalically; corpus bursae elongate, in some species stronger sclerotized caudally; signum shaped as an elongate, more or less broad, sclerotized plate.

Remarks: As already mentioned, Meyrick placed some of the members of this new genus in the genus *Meritastis* Meyrick because of a rather similar wing venation. A close examination, however, shows that the veins R_4 and R_5 of the forewing, as well as M_3 and Cu_1, are approximated closely to each other in *Meritastis* and more widely spaced in the new genus; the ocellus is present in *Meritastis*, but lacking in the new genus; the labial palpus is strongly bent in the latter, with terminal segment somewhat shorter than in *Meritastis*. The genitalia are quite distinct in the two genera: those of the genus *Meritastis* have the general appearance of genitalia in the tribe Archipini, and differ from them only in having the under surface of

the uncus densely clothed with hairs and the sacculus of the valva ornamented and strongly sclerotized in its basal portion. Common (1958, 1963) placed the genus *Meritastis* in his new tribe Epitymbiini, the complete diagnosis of which remains as yet unclear. On the other hand, the new genus shows a close relationship to the genera of the tribe Cnephasiini, and only differs from them in having a plate-shaped signum not yet known in the described genera of this tribe. A complicated gnathos of the new genus is rather unique in the tribe Cnephasiini, although some indications of a similar modification of this structure are known in the Australian genus *Syllomatia* Common (1963).

The seven species of the new genus *Pseudomeritastis* are very similar to each other in the pattern of the forewing, but until more material is available, it would perhaps be hasty to include this character in the diagnosis of the genus.

Key to the Species of *Pseudomeritastis*

1. Hindwing white or light yellowish to pale brownish 2
   Hindwing orange or dark ferruginous 6
2. Front whitish, distinctly paler than remaining head . **distincta,** new species
   Front gray, concolorous with head 3
3. Subterminal fascia of forewing distinctly darker than two large, ferruginous-brown blotches . . . . . **decora,** new species
   Subterminal fascia of forewing not darker than large blotches 4
4. Light gray interspace between subterminal fascia and large, external blotch of forewing divided by a light ferruginous line 5
   Above interspace not divided by any line . . . . . **clarkei,** new species
5. Ferruginous streak in subcostal area of forewing almost reaching point of origin of subterminal fascia . . . . . **cordigera** Walsingham
   This streak by far not reaching subterminal fascia . . . . . **voluta** Meyrick
6. Hindwing orange . . . . . **heliadelpha** Meyrick
   Hindwing dark ferruginous . . . . . **orphnoxantha,** new species

Pseudomeritastis cordigera (Walsingham), new combination

PLATE 1 (FIGS. 1–4), PLATE 2 (FIGS. 1–3)

Tortrix cordigera Walsingham, 1914, *in* Godman and Salvin, Biologia Centrali-Americana, vol. 42 (Lepidoptera-Heterocera, vol. 4), p. 276, pl. 8, fig. 17.
Meritastis voluta (in part).—Meyrick, 1932, Exotic Microlepidoptera, vol. 4, p. 261.

Male genitalia: Uncus with tip slightly bulbose, somewhat stronger sclerotized; middle process of gnathos widely dilated, with two acute, rather short, curved processes, one on each side of middle process; lateral arms of gnathos continued as long, strongly bent appendages directed caudoventrad and densely clothed with setae on inner side of basal portions and on tips. Valva with an elongate, subrectangular cucullus; ledge of sacculus with a longitudinal carina protruding from ventral margin of valva and ending with a short, free, acute tip. Aedeagus tapering apicad; carina penis dorso-externad of caulis.

Female genitalia: Erectile sacs (?osmeteria) on sides of postsegmental membrane of eighth segment, shaped as two large, coniform bags. Apophyses anteriores and posteriores slightly dilated and rounded at tips. Area around ostium bursae membranous, with weak sclerites on sides. Antrum as wide as adjacent portion of corpus bursae; ventral side of caudal portion of bursa copulatrix with a strongly sclerotized area; signum shaped as an elongate, moderately broad, slightly crescent plate.

Type: Holotype, male (genitalia on slide 5797), Volcan de Chiriqui, Chiriqui, Panama, 2000–3000 ft., 1881–1882 (G. C. Champion; 66559); British Museum (Natural History).

Other specimen examined: One female (genitalia on slide 14-Obr., 1963), Volcan Santa Maria, Quezaltenango, Guatemala, June; U.S. National Museum.

Remarks: The external characters of the specimen from Guatemala indicate that it represents a female at *cordigera* which was described on the basis of a male from Panama. Both specimens have similar markings of the forewing; the narrow projection of the basal blotch almost reaches the point of origin of the curved, subterminal fascia. As yet, this feature has been known in *cordigera* only.

Pseudomeritastis voluta (Meyrick), new combination

PLATE 3 (FIGS. 1, 2)

Meritastis voluta Meyrick, [1912], Trans. Ent. Soc. London, 1911, p. 677; 1912, *in* Wagner, Lepidopterorum catalogus, pt. 10, p. 36; 1913, *in* Wytsman, Genera insectorum, fasc. 149, p. 34; 1932, Exotic Microlepidoptera, vol. 4, p. 261.—Obraztsov, 1954, Tijdschr. Ent., vol. 97, p. 189.—Clarke, 1955, Catalogue of the type specimens of Microlepidoptera in the British Museum described by Edward Meyrick, vol. 1, p. 326; 1958, op. cit., vol. 3, p. 156, pl. 78, figs. 2–2b.

Male genitalia: Uncus with tip slightly bulbose, somewhat dilated; middle process of gnathos rotundate-triangular; lateral arms of gnathos short, thick, ending with tufts of setae. Valva with cucullus somewhat narrowed apically; sacculus with a brush of long setae; a slightly projected tubercle on ventral margin of valva, midway between end of this brush and apex of valva. Aedeagus with tip obtuse; carina penis near tip.

Female: Unknown.

Type: Holotype, male (genitalia on slide 6363, JFGC), San Antonio, District Cali, Valle del Cauca, Colombia, 5000 [sic] ft., November 1907; British Museum (Natural History).

Other specimen examined: One male (genitalia on slide, prepared by A. Busck on Apr. 24, 1929), Rio Toche, Quindio Mountains, Colombia, 2400 m.; U.S. National Museum.

Remarks: In the genitalia of the holotype, figured by Clarke (1958), the projected tubercles on the ventral margins of the valvae became partly loose and look like free lobes directed ventrad.

***Pseudomeritastis clarkei*, new species**

PLATE 3 (FIGS. 3–5)

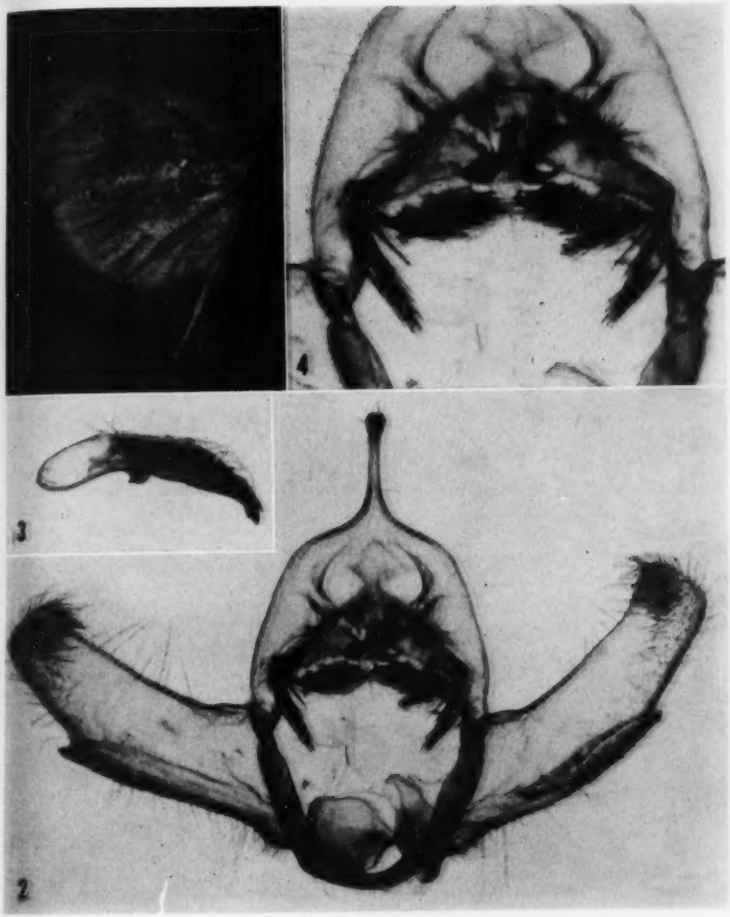
Male: Antenna, labial palpus, head, and thorax light gray; second segment of labial palpus darker apicad, terminal segment brownish gray; posterior crest of thorax ferruginous-brown; abdomen whitish gray. Forewing light gray; markings brown ferruginous, edged and in part transversely strigulated with reddish fuscous, arranged as follows: a rotundate-subquadrate blotch on dorsum towards base, reaching lower vein of discal cell; a longitudinal streak tapering externad, located above this blotch and slightly shorter than half length of discal cell; a much larger, irregularly shaped blotch, also resting on dorsum and occupying most of external half of forewing; upper margin of this blotch roundly excavated; this excavation divides upper portion of blotch in two unequal parts, external of them larger; a longitudinal, whitish streak within this blotch, separating its external upper portion from ground portion of blotch; a triangular, light gray dorsal area between two above-mentioned blotches, vertically striated by brown-ferruginous and connected with light gray, subcostal area; a rather narrow, slightly curved, brown-ferruginous subterminal fascia, edged with reddish fuscous and running from about four-fifths of costa to tornus; a whitish interspace between this fascia and mentioned large blotch; costa narrowly edged with light pinkish brown, and gray dotted beneath this edge; cilia gray at base and whitish gray at tips. Length of forewing 9 mm. Hindwing pale yellowish, slightly darker externally and cream-white basally; cilia light yellowish at base and whitish at tips, with a rather broad, grayish dividing line around apex and parallel to upper portion of termen.

Female: Unknown.

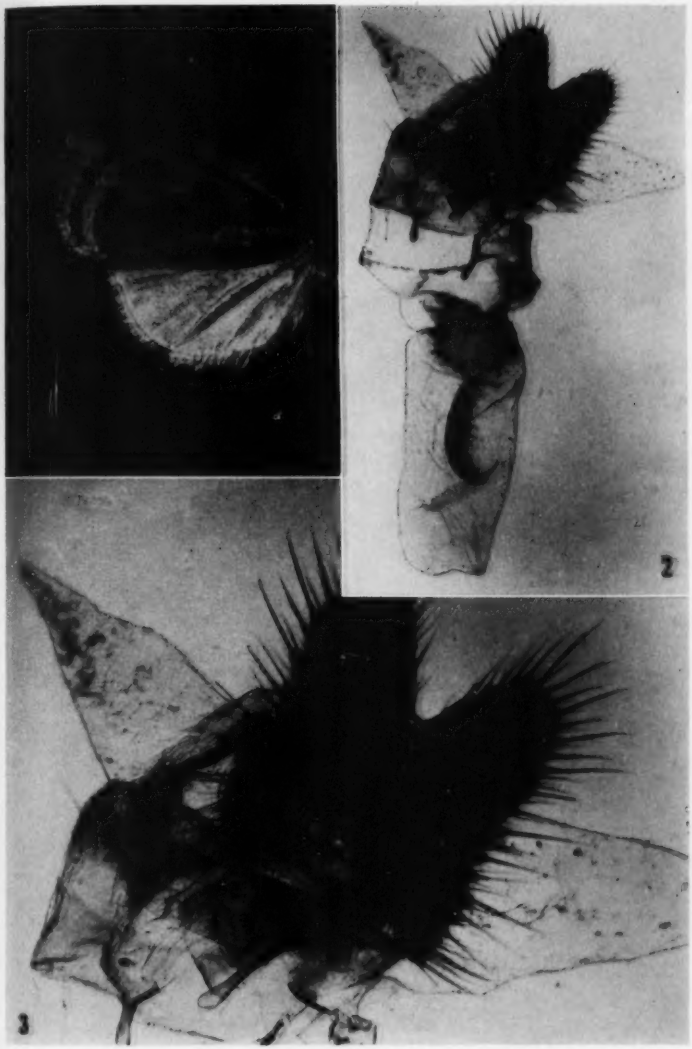
Male genitalia: Apical portion of uncus elongate-spatulate; middle process of gnathos broad, at base with two lateral, angular processes; lateral arms of gnathos shaped as long, curved appendages ending with brushes of long setae. Valva with a broad, moderately setose cucullus; ledge of sacculus with a longitudinal carina protruding from ventral margin of valva and ending with a rather long, free, acute tip. Aedeagus pediform; carina penis dorso-externad of caulis.

Type: Holotype, male (genitalia on slide 15-Obr., 1963), 17 km. southeast of Popayan, Cauca, Colombia, 2000 m., Jan. 10, 1959 (J. F. Gates Clarke); USNM 67368.

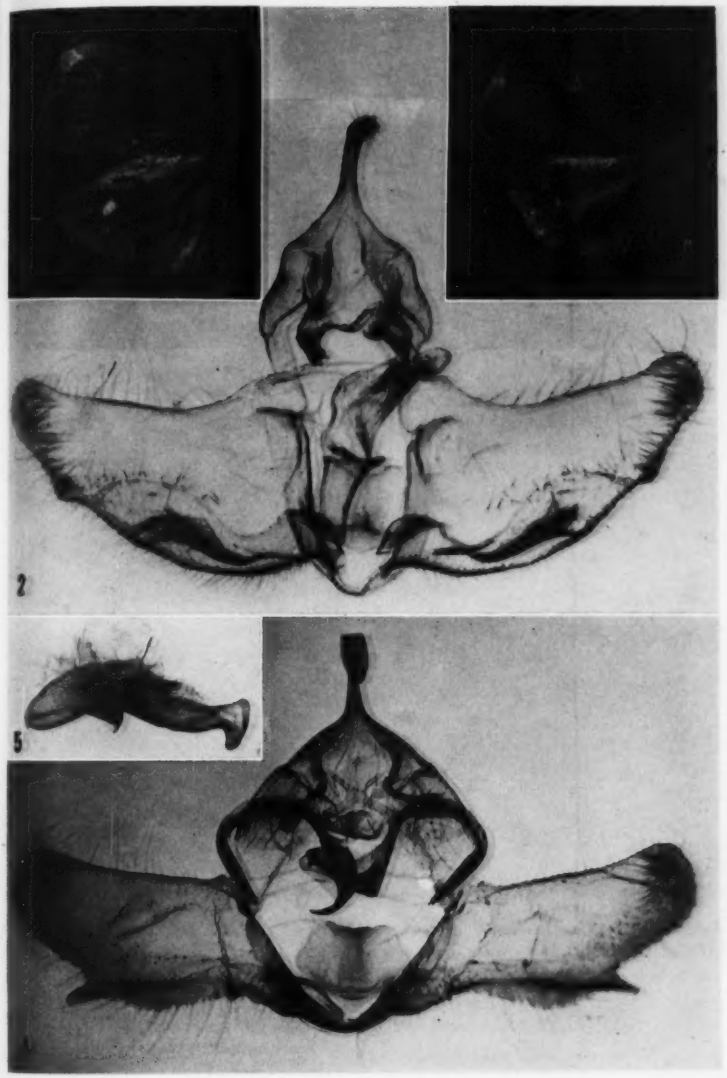
Remarks: Very close to *voluta* Meyrick, but differing in some details of the markings of the forewing, color of the hindwing, and in the



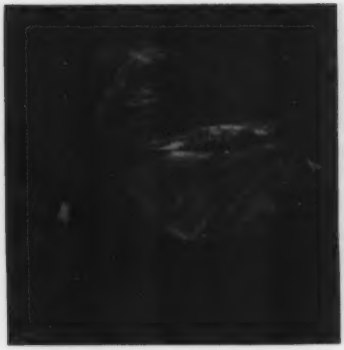
FIGURES 1–4.—*Pseudomeritastis cordigera* (Walsingham), holotype, male: 1, left wings; 2, caudal aspect of genitalia with valvae spread and aedeagus removed; 3, lateral aspect of aedeagus; 4, detail of tegumen with gnathos and socii.

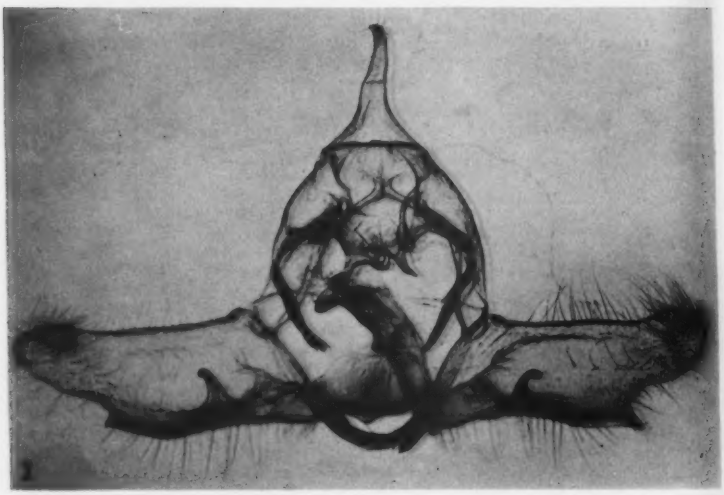


FIGURES 1-3.—*Pseudomeritastis cordigera* (Walsingham), female (slide 14-Obr., 1963): 1, left wings; 2, ventral aspect of genitalia; 3, detail of caudal portion of genitalia.

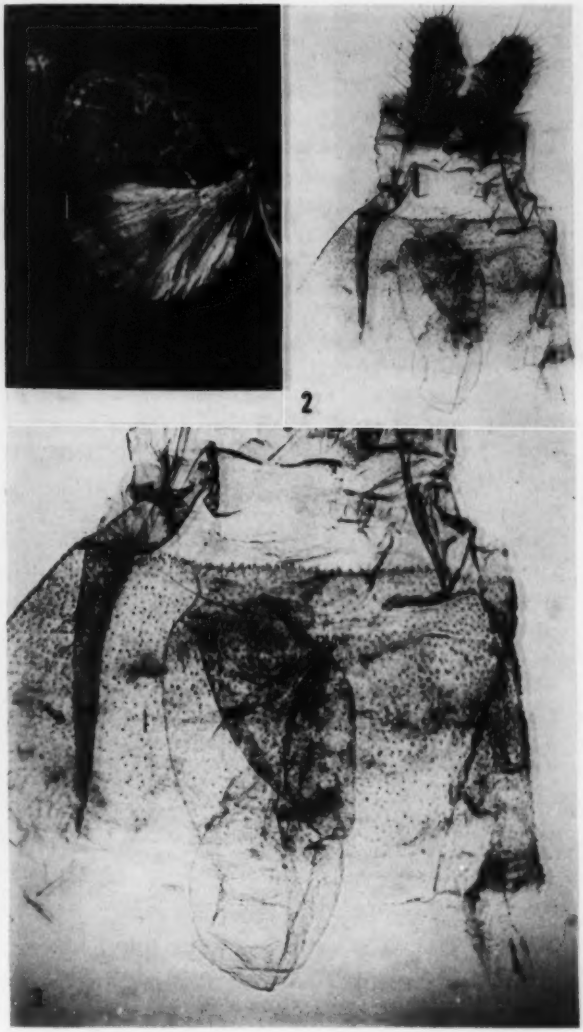


FIGURES 1–5.—*Pseudomeritastis voluta* (Meyrick), male (slide prepared by A. Busck on Apr. 24, 1929): 1, left wings; 2, caudal aspect of genitalia with aedeagus in situ. *Pseudomeritastis clarkei*, holotype, male: 3, left wings; 4, caudal aspect of genitalia with valvae spread and aedeagus removed; 5, lateral aspect of aedeagus.

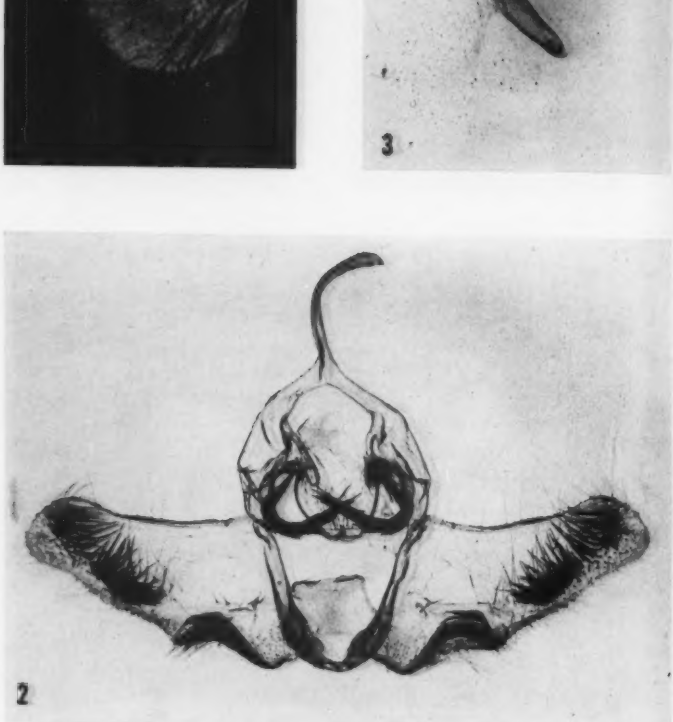




FIGURES 1–3.—*Pseudomeritastis heliadelpha* (Meyrick), paratype, female: 1, left wings. *Pseudomeritastis orphnoxantha*, new species, holotype, male: 2, left wings; 3, caudal aspect of genitalia with aedeagus in situ.



FIGURES 1–3.—*Pseudomeritastis distincta*, new species, holotype, female: 1, left wings; 2, ventral aspect of genitalia; 3, detail of cephalic portion of genitalia.



FIGURES 1-3.—*Pseudomeritastis decora*, new species, holotype, male: 1, left wings; 2, caudal aspect of genitalia with valvae spread and aedeagus removed; 3, lateral aspect of aedeagus.

genitalia. The interspace between the larger (external) blotch of the forewing and the curved, subterminal fascia is not divided by a shadow. The inner margin of the mentioned blotch is straight in the new species, and slightly incurved in *voluta*. The hindwing is distinctly pale yellowish; in *voluta* it is gray whitish, tinged with fuscous reddish towards apex. The shape of the uncus is quite different. The middle process of the gnathos has two well-developed, lateral appendages missing in *voluta*. Instead of a longitudinal carina of the sacculus, observed in the new species, *voluta* has a brush of setae. The aedeagus of the new species is of a unique shape, unknown in any other species of the genus.

This new species is named for its discoverer, my friend and colleague, Dr. J. F. Gates Clarke of the U.S. National Museum.

***Pseudomeritastis heliadelpha* (Meyrick), new combination**

PLATE 4 (FIG. 1)

Meritastis heliadelpha Meyrick, 1932, Exotic Microlepidoptera, vol. 4, p. 261.—Clarke, 1955, Catalogue of the type specimens of Microlepidoptera in the British Museum described by Edward Meyrick, vol. 1, p. 154.

Types: Holotype, male, Rio Zongo (Songo), Bolivia, 2,500 ft.; Naturhistorisches Museum, Vienna (not seen). One female paratype (abdomen missing), same data, 1930; British Museum (Natural History).

Remarks: The female paratype corresponds well with the original description, and undoubtedly belongs to the type lot which was erroneously described by Meyrick (1932) as consisting of two male specimens. The forewings of this paratype are in a less than fresh condition, but the markings are recognizable; the hindwings are deep orange, as in no other species of the genus.

***Pseudomeritastis orphnoxantha*, new species**

PLATE 4 (FIGS. 2, 3)

Male: Antenna, labial palpus, head, and thorax light gray; terminal segment of labial palpus brown. Forewing light gray, paler than thorax; markings brownish ferruginous, edged and in part transversally strigulated with dark brown, arranged as follows: a blotch (somewhat rubbed off and not quite distinct in the examined specimen) on dorsum towards base; its upper projection (or perhaps a separate streak) reaches to upper vein of discal cell; a second larger blotch, also resting on dorsum externad of former blotch, occupies most of external half of forewing and extends almost to tornus; upper margin of this blotch widely excavated; upper portion of blotch, externad of excavation, large and rounded; upper portion of blotch, basad of excavation, acute

angulated, narrow; a slender, gently curved subterminal fascia starting at costa shortly before wing apex and running to tornus; an interspace of ground color, almost as broad as subterminal fascia, located between it and mentioned large spot and divided lengthways by an interrupted, ferruginous line; a dorsal, light gray, triangular area finely striated by ferruginous and located between two mentioned blotches; costa gray dotted; cilia dark gray, whitish at tips. Length of forewing 8.5 mm. Hindwing dark ferruginous; cilia whitish, at base yellowish, with a broad, light ferruginous dividing line.

Female: Unknown.

Male genitalia: Uncus gradually tapering apicad, with tip moderately acute; middle process of gnathos rather narrow, with two acute, lateral processes; lateral arms of gnathos shaped as long, curved appendages, each having a little tooth on inner margin of basal portion and ending with a brush of setae. Valva with an elongate-rotundate cucullus; ledge of sacculus with a longitudinal carina protruding from ventral margin of valva and ending with a free, acute tip; an elevated, slightly curved and apically somewhat bulbose harpe located on carina of sacculus slightly before its middle. Aedeagus spatulate at tip; carina penis near apex of aedeagus.

Type: Holotype, male (genitalia on slide, prepared by A. Busck on Sept. 30, 1932), Tuis, Costa Rica, 2400 ft. USNM 67369.

Remarks: Because of the ferruginous hindwings of this species, A. Busck identified it as *heliadelpha* Meyrick. Actually, the hindwings of the latter species are much paler, orange colored. Moreover, the new species differs in having the costa of the forewing less arched than in *heliadelpha*, the subcostal area above the large dorsal blotch somewhat narrower, and the upper internal angle of this blotch more acute. Presence of a harpe on the carina of the sacculus is a special character of the new species, not observed in any other species of the genus.

The name *orphnoxantha* is derived from the Greek *ορφνος*, meaning dark, and *ξάνθος*, meaning yellow.

***Pseudomeritastis distincta*, new species**

PLATE 5 (FIGS. 1–3)

Female: Antenna light gray, on under surface pale ferruginous; scapus and annulation of upper surface of antennal segments dark gray; labial palpus whitish, concolorous with front of head; most of head and thorax light gray, but distinctly darker than front; anterior portion of thorax and its posterior crest brownish ferruginous. Forewing light gray; markings ferruginous-brown, edged and in part

transversely strigulated with dark brown, arranged as follows: a rotundate-subquadrate blotch on dorsum towards base, reaching lower vein of discal cell; an oblique streak starting costobasad of this blotch, closely touching it at base, and continued along discal cell to above a second blotch; this latter, much larger than basal blotch, also rests on dorsum and is irregularly shaped; its upper margin is narrowly excavated, dividing upper portion of blotch in two unequal parts, external of them larger and rounded; basal upper part of blotch with a minute angle on inner margin; within blotch a short, whitish streak between veins M_2 and M_3; a triangular, light gray dorsal area between two mentioned blotches, opened costally and striated vertically by three ferruginous lines joined together at vein A_{2+3} and continued as two parallel lines along interspace between basal streak and larger of blotches; a rather narrow, slightly curved ferruginous-brown subterminal fascia starting at about three-quarters of costa and reaching upper portion of tornus; a pale ferruginous shadow dividing lengthways interspace between this fascia and larger of blotches; this shadow becomes somewhat olive in its upper portion, and in subcostal area joins a dilated streak; costa narrowly edged with ferruginous, and dark dotted beneath this edge; some concolorous dots in subterminal area; cilia dark gray at base and whitish at tips. Length of forewing 12 mm. Hindwing pale cream-white, shining, becoming brownish at termen; cilia white with gray dividing line at base, more distinct around wing apex.

Male: Unknown.

Female genitalia: Erectile sacs on sides of postsegmental membrane of eighth abdominal segment (on the only preprepared slide they are badly damaged). Apophyses posteriores not dilated at tips; apophyses anteriores with tips slightly dilated. Entire area around ostium bursae membranous. Antrum short infundibuliform, in cephalic portion slightly narrower than adjacent portion of corpus bursae. Corpus bursae with a large (on the slide somewhat folded), broad, moderately sclerotized signum shaped as a plate rounded cephalically.

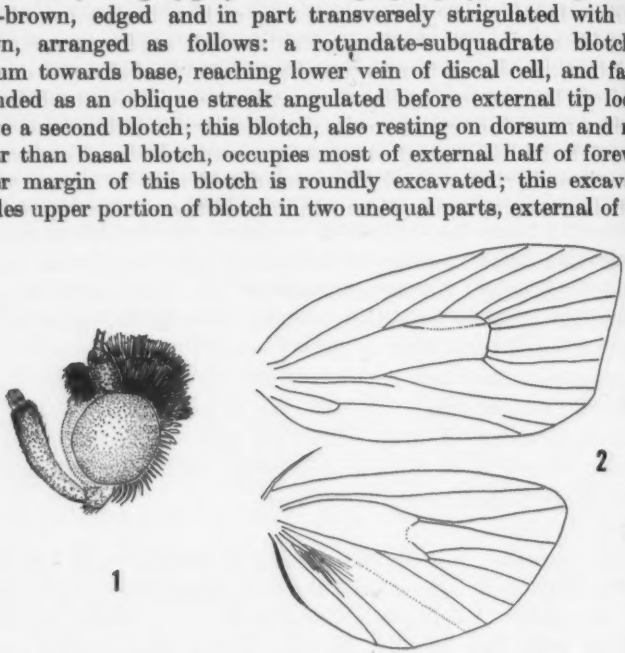
Type: Holotype, female (genitalia on slide, prepared by A. Busck on Apr. 24, 1929), La Florida, Costa Rica, 500 ft.; USNM 67370.

Remarks: Very similar to *cordigera* Walsingham, but having the front of the head whitish, markings of the forewing darker, and the shadows dividing the light interspaces more distinct. The upper projection of the basal blotch is not as long as in *cordigera*, and does not extend far distad. The genitalia are distinguished by the ostium bursae slightly narrower than the corpus bursae, and the apophyses posteriores not dilated at tips.

***Pseudomeritastis decora*, new species**

FIGURE 1; PLATE 6 (FIGS. 1–3)

Male: Antenna pale gray yellowish, on under surface ferruginous; labial palpus with basal segment whitish, second gray, brownish ferruginous apicad, and terminal segment brownish ferruginous; head and thorax [damaged] gray. Forewing light gray; markings ferruginous-brown, edged and in part transversely strigulated with dark brown, arranged as follows: a rotundate-subquadrate blotch on dorsum towards base, reaching lower vein of discal cell, and farther extended as an oblique streak angulated before external tip located above a second blotch; this blotch, also resting on dorsum and much larger than basal blotch, occupies most of external half of forewing; upper margin of this blotch is roundly excavated; this excavation divides upper portion of blotch in two unequal parts, external of them



FIGURES 1, 2.—External characters of the genus *Pseudomeritastis*: 1, head of *P. decora*, new species, male; 2, wing venation of *P. voluta* (Meyrick), male.

larger and more rotundate; a short, longitudinal, whitish streak within blotch, separating its external upper part from remaining, ground portion of blotch; a triangular, light gray interspace on dorsum, opened costally and strigulated with ferruginous, located between two mentioned blotches, and continued between external blotch and streak of basal blotch; a rather narrow, slightly curved, dark brown subterminal fascia from about four-fifths of costa to tornus; between this fascia and external blotch a whitish interspace divided lengthways by a ferruginous line turned basad in subcostal area and dilated there as a streak connected with already mentioned streak above basal blotch; costa ferruginous edged, with grayish dots beneath; apicoterminal portion of forewing darker than subcostal area, with

indistinct, darker gray dots and strigae; cilia gray, whitish at tips. Length of forewing 10 mm. Hindwing white, slightly creamy; cilia white, somewhat pale brownish at base.

Female: Unknown.

Male genitalia: Uncus slender, slightly dilated and pointed at tip; gnathos fused in central portion with subscaphium; middle process of gnathos short, acute; lateral processes lacking; lateral arms of gnathos long, strongly curved, setose at tips and inner surface of basal portion. Valva with a long, irregularly rounded and in basal portion densely seted cucullus; sacculus with a broad, curved carina ending with a brush of setae in a slight, rotundate projection of ventral edge of valva; an elongate, rather flat, longitudinal harpe costobasad of mentioned brush. Aedeagus with a rather long, narrow tip; carina penis halfway between tip of aedeagus and caulis.

Type: Holotype, male (genitalia on slide 13-Obr., 1963), Incachaca, Cochabamba, Bolivia, tropical cloud area, 2100 m., between Aug. 27 and Sept. 5, 1956 (L. Peña); USNM 67371.

Remarks: Differs from other species of the genus in having the subterminal fascia of the forewing distinctly darker than the blotches. Very characteristic is the presence of a harpe of the valva, distinct in its shape and direction from that in *orphnoxantha*, new species.

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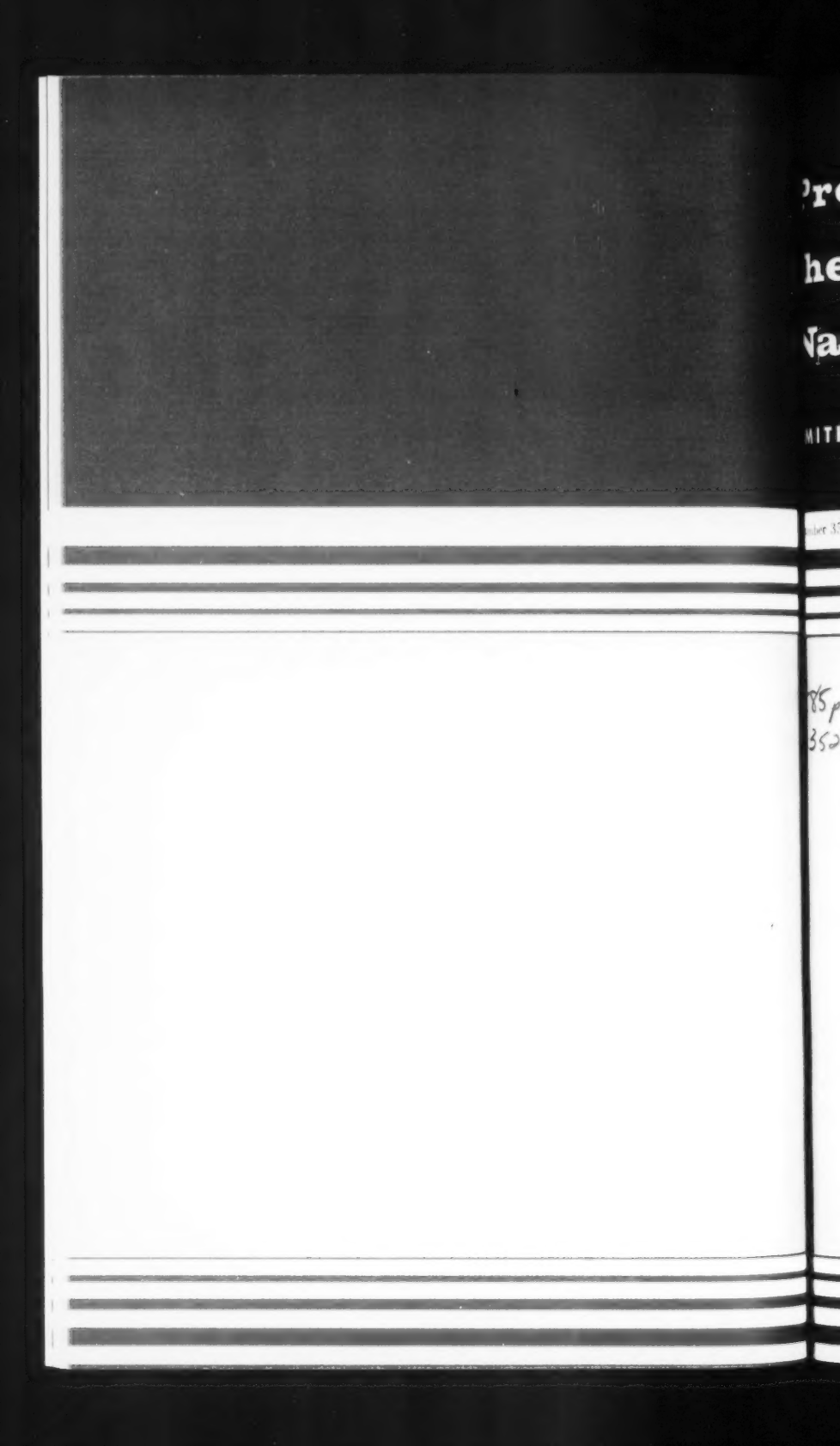

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MORE NEW GALERUCINE BEETLES WITH EXCISED MIDDLE TIBIAE IN THE MALE

By DORIS H. BLAKE

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MORE NEW GALERUCINE BEETLES WITH EXCISED MIDDLE TIBIAE IN THE MALE

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This paper is a supplement to "A Review of Some Galerucine Beetles with Excised Middle Tibiae in the Male" (Proc. U.S. Nat. Mus., vol. 108, 1958) which, owing to its delayed publication, appeared subsequent to a paper by J. Bechyne (Ent. Arb., vol. 7, 1956), wherein he described the genus *Trichobrotica*, giving the same type of the genus, *Neobrotica sexplagiata* Jacoby, that I had for my new genus *Iceloceras*. He described only one new species under this, *Trichobrotica brasiliensis*, the type of which I have examined. Since it is my *Iceloceras flavipes*, I am transferring to the genus *Trichobrotica* those species described by me under *Iceloceras* although I recognize that some of them do not fit entirely into the rather narrow limits of Bechyne's genus described from two very similar species and having as the only characters coarsely punctate elytra with sparse pubescence and with vertical elytral epipleura visible the entire length. Bechyne did not note the excised middle tibiae in the male, which, together with the lack of any sexual differences in the antennae, I had taken as characters separating *Iceloceras* from other genera with excised middle tibiae. In general most beetles of the group with excised middle tibiae have unusual antennal development in the male also. In *Trichobrotica* I

have included those with antennae that do not change to any extent in the male. Some of the species that I have allocated to *Trichobrotica* differ from *T. sexplagiata* in having the third antennal joint short, as in *T. ruatanae* (Jacoby). These species may eventually be placed elsewhere.

In trying to classify these Galerucine beetles one is constantly meeting some characters that are found in one genus in species that otherwise seem predominately to belong to another genus. I have been reluctant to make new genera for these species that are mainly one of a kind until others like them turn up, which I am confident in time will be the case. For the present I have included such species in the genus to which they appear to be more closely related. More than in any group with which I have ever worked, these beetles intermingle in their characters so that few of the genera are clear cut. Six of the species dealt with in this paper, all having excised middle tibiae in the male, have been described as *Neobrotica*, four as *Diabrotica*, and others as species of *Phyllobrotica*, *Luperus*, and *Chthoneis*.

In a later publication (Ent. Arb. vol. 9, 1958) Bechyne has described the two new genera *Deuterobrotica* and *Romanita*, in both of which the males have excised middle tibiae, although here again Bechyne has made no mention of this character. He took as type of the first genus *Diabrotica amplicornis* Baly, which species I had placed rather doubtfully in *Luperosoma*. He described two other closely related species, each represented only by a female, as species of *Neobrotica*, *N. latifrons* and *N. lineigera*, separating them from *Deuterobrotica* because they did not have enlarged antennal joints, which, of course, is purely a male character.

In the genus Bechyne described as *Romanita*, he named *R. amazonica* as the genotype and described three more species of widely different aspect and doubtfully assigned Weise's *Neobrotica fasciata* as the fifth species. Since they are all females it is impossible to be certain that they are congeneric. I have made drawings of those that I have been able to examine for the enlightenment of future workers in the group.

For another group of beetles somewhat resembling *Romanita amazonica* but differing in the head and antennal characters, I have erected the genus *Porechontes* because of the large pore in the middle of the front of the head in the male. It resembles *Romanita amazonica* in having the third antennal joint very short, but the apical joints tend to be widened triangularly in the male. The species that I tentatively described as *Platymorpha albiventris* in my earlier paper belongs here. Two other species have come to my attention, all three having a similar pore in the middle of the front of the head.

Among other Galerucine beetles having the middle tibiae excised in the male are two very different groups, both with bifid claws instead

of the usual appendiculate ones. One species of the first group so closely resembles a species of *Trichobrotica* in general appearance that it would appear to be only a color form. The other species has been described first by Weise as *Phyllobrotica subtilis*, and later by Bechyne as *Neobrotica achroma*, but it belongs to neither genus with its bifid claws. For these species I have erected the genus *Neotrichota*.

The second group with bifid claws is most remarkable for its bizarrely formed antennal joints in the male. No female of any of the three species has been examined. All three bear a close resemblance to each other in elytral markings as well as in having the antennal joints similar though distinctly different in each. The only specimens of *Diabrotica pectinicornis* Baly I have ever seen, which I have taken as the type of this genus, are one collected at Cauca, Colombia, in the British Museum, and one collected in "Bolivia," in the Bowditch collection. The second species, which is new, was taken at Tingo Maria, Peru, and the third, also new, at Turrialba, Costa Rica.

John Wilcox has discovered in the U.S. National Museum collection a second species of that odd genus *Oroetes*, originally described from Panama. The second species was taken in Bolivia. It has a similar but smaller modification of the third and fourth antennal joints in the male, and as in *O. flavicollis* there are only ten antennal joints in the male, and the excavation of the face is similar.

I wish to acknowledge my indebtedness to the U.S. National Museum (USNM), the Museum of Comparative Zoology (MCZ), and the British Museum (Natural History) (BMNH), for the material on which this study is based. Mr. Hugh Leech also has picked out material for me to study at the California Academy of Sciences (CAS), and for some years John A. Wilcox has been assiduously finding specimens for me in the collections with which he has worked. I have visited the Frey Museum at Tutzing near Munich to study Bechyne's types and also the British Museum (Natural History) on a grant from the National Science Foundation. A later grant from the National Science Foundation has enabled me to examine insect collections in Brazil, Argentina, Peru, and Colombia.

Key to the Genera of Galerucinae Here Treated

1. Claws bifid 2
   Claws appendiculate 3
2. Antennae in male bizarrely shaped with greatly enlarged 9th and 10th antennal joints . . . . . **Deinocladus**, new genus
   Antennae in male no different from female . . . . **Neotrichota**, new genus
3. In male, the face excavated, 3rd and 4th antennal joints with excision at adjoining ends, a node anteriorly in the middle of pronotum . . **Oroetes**
   Face and antennae in male not excavated, no median node 4

4. Disc of pronotum not at all sulcate. West Indies . . . . . **Ectmesopus**
   Disc of pronotum usually more or less sulcate 5
5. Antennae in male filiform with 3rd joint somewhat shorter than 4th . . . . **Trichobrotica**
   Antennae in male with 3rd joint short, often cup shaped, 4th joint usually much longer 6
6. Terminal antennal joints in male not thickened 7
   Terminal antennal joints in male thickened 11
7. Face of male with a spine over the labrum . . . . . **Platymorpha**
   Face of male without a spine 8
8. Antennae in male with median joints (5–7 or more) somewhat enlarged, front of face flat 9
   Median joints of antennae in male not enlarged, front of face rather bulging 10
9. Joints 5–7 in male slightly enlarged . . . . . **Simopsis**, new genus
   Joints 5–9 in male noticeably enlarged . . . . . **Luperosoma**
10. In male, front of face with a median pore, antennal joints 9 and sometimes 10, somewhat triangularly widened at apex . . . **Porechontes**, new genus
    Front of face in male without a median pore, antennae filiform . . **Romanita**
11. North and Central America and Northwestern South America . **Luperosoma**
    Southern Brazil . . . . . **Deuterobrotica**

***Trichobrotica nymphaea flavicollis*, new subspecies**

FIGURE 3

About 3.5 mm. in length, oblong oval, the middle tibiae in the male deeply excised near the apex, pale yellow with a wide brown elytral vitta covering most of each elytron, the margin and suture yellow, legs with a brown streak on the femora, tibiae and tarsi and antennae brown, the antennae with the three apical joints yellow.

Head with the interocular space approximately half width of head, occiput shining, impunctate, frontal tubercles distinctly marked, a narrow carina down lower front, entirely pale yellow. Antennae very long and slender, the third joint a little shorter than fourth, remainder subequal, brownish with the three terminal joints pale yellow, tip of apical one dark. Prothorax a little wider than long with nearly straight sides, a faint depression in basal half, not well marked, shining, entirely pale yellow. Scutellum pale. Elytra finely and not densely punctate, with scattered erect hairs, margin pale and a wide pale sutural vitta, on each elytron a broad dark-brown vitta wider near the scutellum. Body beneath entirely pale, the femora with a dark streak above on the anterior pair and the apices of the femora dark in the two posterior pairs, tibiae and tarsi brown, the middle tibiae of the male deeply incised near apex. Length 3–3.8 mm.; width 1.5–1.8 mm.

Type, male, USNM 66856, from Paraiso, Canal Zone, one female paratype, taken Feb. 6, 1911, and Mar. 30, 1911, respectively, by E. A. Schwarz and A. H. Jennings.

Remarks: The male is an immature specimen with shriveled abdomen which I did not try to dissect. Although both specimens lack the pronotal vittae characteristic of *T. nymphaea* (Jacoby), the specimens in other ways resemble that species so much that I believe they are but a color race of it.

***Trichobrotica rhabdota*, new species**

FIGURE 8

About 3 mm. in length, oblong oval, shining, nearly impunctate, the middle tibiae of the male excised near the apex, elytra with a few erectish hairs, pale yellow, each elytron with a wide brownish vitta extending from over the humerus to cover half of elytra at base and widening towards apex, margin pale.

Head with the interocular space approximately half width of head, occiput rounded, polished, impunctate, frontal tubercles well marked, a narrow carina down front, entirely pale yellow. Antennae yellowish brown, long, slender, the four terminal joints missing. Prothorax only a little wider than long with nearly straight sides, a depression in basal half, shining, pale yellow. Scutellum pale. Elytra shining, nearly impunctate, pale yellow with a wide brown vitta on each elytron, leaving the margin and a wide sutural pale vitta. Body beneath entirely pale, the legs entirely pale, middle tibiae of the male with a small notch, front tibiae and first tarsal joint a little stouter. Length 3 mm.; width 1½ mm.

Type, male, MCZ 30675, from Aracataca, Magdalena Province, Colombia, collected by P. J. Darlington, Jr.

Remarks: This is close to the Panama subspecies, *T. nymphaea flavicollis*, but the legs are entirely pale and the dark elytral vitta not so wide. The aedeagus of this species also differs from that of typical *nymphaea* in not being rounded but pointed at the tip.

***Trichobrotica egensis*, new species**

FIGURE 5

About 3.5 mm. in length, elongate oblong oval, shining, the elytra finely punctate, the prothorax with a transverse depression, pale yellow brown, a piceous vitta on both sides of pronotum and a wide piceous elytral vitta on each elytron joined at the apex.

Head with the interocular space approximately half width of head, a well-rounded occiput, frontal tubercles distinct, a narrow carina down front, entirely pale yellow brown. Antennae pale at base, third and fourth antennal joints about equal, the rest missing. Prothorax somewhat wider than long with nearly straight sides, a wide transverse sulcus and on either side a wide piceous vitta. Scutellum pale. Elytra shining, finely punctate, pale yellow with a broad

piceous vitta covering half of each elytron and uniting at apex. Body beneath and legs entirely pale, anterior coxal cavities open, claws appendiculate. Length 3.6 mm.; width 1.5 mm.

Type, female, BMNH, from Ega, Brazil.

Remarks: This is closely related to *T. rhabdota* from Colombia and *T. nymphaea* (Jacoby) from Panama, but differs from either in the elytral pattern with the elytral vittae joined at the apex. Although only a female is known, the male will undoubtedly have notched middle tibiae.

***Trichobrotica nigripennis*, new species**

FIGURE 2

About 4.5 mm. in length, elongate oblong oval, moderately shiny, the elytra closely and coarsely punctate, middle tibiae of the male excised near the apex, pale yellow, the occiput of head tan colored, antennae, tibiae, and tarsi dark, femora with a dark streak, pronotum with a piceous vitta on either side, elytra piceous with a pale margin.

Head with the interocular space approximately half width of head, occiput shiny, very finely punctate, frontal tubercles swollen, a depression in the middle above them, carina very short, lower front punctate. Antennae long, slender, dark, joints five to seven a little thicker. Prothorax a third wider than long, with wide transverse depression, pale with a piceous vitta on each side at the end of the sulcus, surface shiny, impunctate. Scutellum pale. Elytra with the punctures contiguous, coarse, shallow, surface somewhat shiny, piceous, with a pale margin. Body beneath entirely pale, femora pale in basal portion, with a dark streak and dark apex, tibiae and tarsi piceous. Coxal cavities open, claws appendiculate. Length 4.5 mm.; width 1.7 mm.

Type, male, BMNH, from Ecuador, 1920, Gilbert Hammond collector.

Remarks: This is closely related to *Trichobrotica sexplagiata* (Jacoby) and closely resembles *T. biplagiata* Blake in coloring but lacks the pale elytral spots and the aedeagus is quite different.

***Trichobrotica analis* (Weise)**

FIGURE 23

Neobrotica analis Weise, Ark. Zool., vol. 14, no. 1, p. 95, 1921.

About 5 mm. in length, oblong oval, moderately shiny, although alutaceous, elytra with traces of shallow nearly obsolete punctation, especially noticeable in the middle pale spot, moderately convex, without depressions, prothorax with a shallow transverse depression; yellowish or reddish brown, the antennae except the penultimate joint dark brown, tibiae and tarsi dark, and elytra dark piceous with six

large pale spots on disc and two along each lateral margin, middle tibiae of male excised near apex.

Head pale reddish or yellowish brown, shiny, rounded over the occiput with a median depression above the well-marked frontal tubercles, a narrow carina down lower front on both sides of which the surface is densely and coarsely punctate. Antennae with the third joint a little shorter than the fourth, rest subequal, brown except for the pale tenth joint. Prothorax a little wider than long with somewhat arcuate sides and a shallow transverse depression, shiny, reddish or yellowish brown. Scutellum pale. Elytra moderately convex, without depressions except the short intrahumeral sulcus, alutaceous and strongly and confusedly punctate, deep piceous, each elytron with three large pale spots, the median being almost a fascia but interrupted at the suture; along the sides of the lateral margin two pale spots. Epipleura vanishing at apical curve. Body beneath pale with the femora for the most part pale with a dark streak above, hind femora dark at apex, tibiae and tarsi dark. Anterior coxal cavities open, claws appendiculate, middle tibiae of male excised near apex, hind tibiae with spine. Length 4.9–5.5 mm.; width 2.4–2.7 mm.

Type, male, and female paratype, in Naturhistoriska Riksmuseet, Stockholm, Sweden, collected at Manáos, Amazon, Brazil, by Roman.

Remarks: This species described by Weise as a *Neobrotica* has excised middle tibiae and falls in the genus *Trichobrotica*.

***Trichobrotica pallida* (Jacoby)**

FIGURE 1

Neobrotica pallida Jacoby, *in* Godman and Salvin, Biologia Centrali-Americana, Coleoptera, vol. 6, pt. 1, suppl., p. 335, 1892.

About 4 mm. in length, oblong oval, shining, almost impunctate, pale yellow with the antennae, tibiae and tarsi and a dark apex or streak on the femora, middle tibiae of the male excised near apex.

Head with interocular space half width of head, occiput smooth, no depression above frontal tubercles, carina short, lower front short. Antennae long, dark and hairy, the third joint a little longer than second but much shorter than fourth. Prothorax a little wider than long, sides nearly straight, a well-marked transverse sulcus. Scutellum rounded. Elytra wider below the middle, impunctate, with a little depression below the slight basal convexity, and another transverse depression below the middle. Body beneath with the anterior coxal cavities open, the middle tibiae excised in the male, the claws appendiculate, entirely pale, the anterior femora with a dark streak above, the hind femora dark at apex, tibiae and tarsi entirely dark. Length 4.2 mm.; width 2 mm.

Type, male, BMNH, from Panistlahuaca, Mexico, Sallé collector.

Remarks: In Jacoby's description he states that he has two specimens. Only one is now at the British Museum and there is none in the Bowditch collection. Jacoby described the antennae as having the last two segments missing, which applies to the specimen in the British Museum. The shallow notching of the middle tibiae is more typical of the genus *Platymorpha*, but the third antennal joint is not so compressed as in that genus, and in this respect is similar to that of *Trichobrotica ruatanae* (Jacoby).

***Trichobrotica nigrosignata* (Jacoby)**

FIGURE 17

Diabrotica nigrosignata Jacoby, *in* Godman and Salvin, Biologia Centrali-Americana, Coleoptera, vol. 6, pt. 1, p. 522, 1887.

About 3.5 mm. in length, elongate oblong oval, shining, the elytra very finely and not densely punctate, pale yellow with dark antennae and dark tibiae and tarsi, and on each elytron three dark markings, one from the humerus down the side nearly to the middle, another short one from the base down the middle, and the third large spot near the apex; middle tibiae of the male excised.

Head with the interocular space about half width of head, occiput smoothly rounded, very finely punctate, no depression above the frontal tubercles, a narrow carina down lower front. Antennae long, dark brown, with the second and third joints short. Prothorax almost as long as wide with slightly rounded sides and a shallow depression across lower half. Scutellum pale. Elytra narrowly oblong and a little wider at apex, depressed, very finely punctate, shining, pale yellow with three dark markings on each elytron: the first from the humerus along the side to the middle, the second a very short curved vitta from the middle of the base, and the third a large dark spot near the apex. Body beneath pale, the femora pale, the tibiae and tarsi dark. Claws appendiculate. Length 3.2–4.9 mm.; width 1.4–1.5 mm.

Type, male, BMNH, and 4 paratypes, from San Geronimo, Guatemala, Champion collector. One specimen from San Isidro, Guatemala, 1600 ft., Champion collector.

Remarks: In two specimens the lateral spots are united along the side. This species with its excised middle tibiae in the male and appendiculate claws belongs rather in *Trichobrotica* than *Diabrotica*. The short third antennal joint resembles that of *T. ruatanae* (Jacoby).

***Trichobrotica fenestrata*, new species**

FIGURE 14

About 4 mm. in length, elongate oblong oval, shining, the prothorax with a transverse scooped-out area in the lower half, elytra very finely

punctate, yellow brown with dark antennae, a piceous occiput on the head and a darkening over the anterior half of the pronotum, a wide dark area extending from the base of elytra over the humerus and down the side, widening to cover lateral half below the middle, margin and interior pale, body beneath pale with the breast brown, the tibiae and tarsi and apical half of femora piceous.

Head with the interocular space about half width of head, occiput smoothly rounded, frontal tubercles distinct, a well-defined carina down lower front, the occiput and around eyes piceous, front pale, mouthparts brownish. Antennae piceous (last two joints missing), third joint a little longer than second, remainder much longer. Prothorax with nearly straight sides, about a third wider than long, a scooped-out area in the basal half; shiny, yellow brown with the anterior half darkened. Scutellum pale. Elytra shiny although finely alutaceous, very finely punctate, somewhat flattish with small humeral prominences and short intrahumeral sulcus, yellow brown with a piceous band across base extending down over the humeri and along the side and widening in apical half to cover half the elytra, the explanate margin wide and pale, interior pale; body beneath pale with the breast brownish, basal part of femora pale, apical half, tibiae, and tarsi dark. Length 4 mm.; width 1.7 mm.

Type, female, CAS, from Cordoba, Mexico, A. Fenyes collector.

Remarks: Only a female of this species has been examined and without the male it is impossible to be certain into which genus it falls, but the front of the head resembles more the species of *Trichobrotica*.

Neotrichota, new genus

Type species: *Neotrichota flavipennis*, new species.

Elongate oblong oval, head with well-marked frontal tubercles and a short carina down the lower front; antennae long and filiform, the third joint longer than the second. Prothorax nearly rectangular with slightly curved sides and explanate margin, a shallow scooped-out area in lower half. Elytra with small humeral prominences, slightly wider towards the apex. Anterior coxal cavities open, middle tibiae of the male notched near apex, the first tarsal joint of the hindlegs scarcely as long as the rest of the joints together, claws bifid.

This genus resembles species of *Trichobrotica* except that the claws are not appendiculate but bifid. In this respect the genus is like *Deinocladus*, and these two genera alone stand out as having bifid claws in a group in which the claws are appendiculate.

The name *Neotrichota* is derived from the Latin "neo," meaning new, and "trichota," an abbreviation of *Trichobrotica*.

Neotrichota subtilis (Weise)

FIGURES 10, 11

Phyllobrotica subtilis Weise, Ark. Zool., vol. 14, no. 1, p. 104, 1921.
Neobrotica achroma Bechyne, Ent. Arb. Mus. G. Frey, vol. 9, no. 8, p. 596, 1958.

About 4 mm. in length, oblong oval, very shiny, the prothorax with a shallow scooped-out depression in the lower half, the elytra with a short intrahumeral depression, the pronotum rather sparsely punctate, the elytra more densely and strongly punctate, entirely pale yellow except the tip of the mouthparts which are brownish, claws bifid.

Head with the interocular space half width of head, polished, impunctate over occiput, frontal tubercles well marked, lower front smooth with a short carina. Antennae long, first joint very long, second joint shorter than third, and third joint shorter than fourth, the remainder long and slender, a little darker. Prothorax with nearly straight sides, the basal half with shallow scooped-out area, shiny, rather sparsely punctate, pale yellow. Scutellum pale. Elytra wider towards apex, with small humeral prominences and a short intrahumeral sulcus, shiny, densely and moderately coarsely punctate, pale yellow. Body beneath and legs pale, the middle tibiae of the male notched near the apex. Claws bifid. Length 4 mm.; width 1.8 mm.

Type, male, in Riksmuseum, Stockholm, Sweden, collected on the Rio Autaz, Amazon, Roman collector. Two other specimens from Santarem, Brazil, in the Carnegie Museum. A female (type of *Neobrotica achroma* Bechyne) in the G. Frey Museum, Tutzing bei München, Germany, collected at Cayenne, French Guiana.

Remarks: Both Bechyne's and Weise's types have been examined by the writer and they are the same. Because of the bifid claws this species cannot be included in the genus *Trichobrotica* which it strongly resembles. For the same reason it cannot be a species of either *Phyllobrotica* or *Neobrotica*.

Neotrichota flavipennis, new species

FIGURE 12

About 4.5 mm. in length, elongate oblong oval, faintly shining, the elytra densely and strongly punctate, the prothorax transversely depressed in the basal half, middle tibiae of the male excised; pale yellow with the three terminal antennal joints brown, and with a pale reddish brown vitta on each side of the prothorax.

Head with the interocular space approximately half width of head, frontal tubercles somewhat swollen with a depression above them, a short carina down the lower front, which is smooth, without depressions and with long pale hairs, upper half of head a deeper yellow

than the lower front. Antennae extending below the middle of the elytra, joints long, slender and from the third to eighth joints subequal, last three joints deep brown. Prothorax about rectangular with the sides nearly straight, a slightly scooped-out depression in the basal half, surface shining, punctate along the base, pale yellow with a pale reddish-brown vitta on each side wider anteriorly but not meeting in middle. Scutellum pale yellow. Elytra elongate, a well-marked intrahumeral sulcus, densely and moderately coarsely but shallowly punctate, pale yellow, a few hairs at apex. Body beneath entirely pale yellow, the front tibiae thickened and middle tibiae notched near the apex in the male. Claws bifid. Length 4.5–5 mm.; width 1.8–2 mm.

Type, male, and 2 paratypes, USNM 66857, from Mr. Peter's Hall, 2 miles from Georgetown, British Guiana, Sept. 22, 1918, collected by Harold Morrison.

Remarks: This is another species with bifid claws but strongly resembling the *Trichobrotica sexplagiata* group with notched middle tibiae in the male and similar shape and markings except that the elytra are entirely pale.

***Ectmesopus rhabdotus*, new species**

FIGURE 32

About 3 mm. in length, oblong oval, shining, the antennae in the male with the tenth joint wider than the rest and the middle tibiae excised; pale yellow brown with the occiput of the head dark, the prothorax with a piceous lateral vitta on either side, elytra shining with a blue-violet luster, tibiae in the apical half deeper brown.

Head smoothly rounded over the occiput with fine punctures over the rather indistinct frontal tubercles, a narrow carina, pale yellow with the occiput of the head having a darkened area behind the eyes and the tip of the mouthparts also dark. Antennae in the male with joints eight to ten gradually thickening, the tenth joint the widest, basal and terminal joints pale yellow brown, the remainder gradually deepening in color to the tenth which is piceous. Prothorax a little wider than long, with nearly straight sides, disc smooth and without depressions, shining, impunctate, pale yellow brown with a piceous vitta extending to margin and nearly the length of the pronotum on each side. Scutellum brown. Elytra blue violet, shining, in the one specimen examined the elytra much wrinkled, the specimen being immature. Body beneath entirely pale, the legs pale with the apical half of tibiae brown. Length 2.8 mm.; width 1.2 mm.

Type, male, USNM 66855, collected at Bahia Honda, Cuba, on June 1–3, by H. F. Wickham.

Remarks: The markings of this species resemble those of *E. vitticollis* Blake from Puerto Rico except that the vittae on the prothorax are longer. The graduated enlargement of the eighth to tenth antennal joints is different from any of the other species.

***Luperosoma vittatum*, new species**

FIGURE 19

About 3.5 mm. in length, elongate oblong oval, shining, the elytra finely punctate, in the male the fifth to eighth antennal joints enlarged and the middle tibiae excised, pale yellow brown with a broad piceous vitta on each side of prothorax and a broad piceous vitta nearly covering each elytron leaving the margin and a narrow pale sutural vitta.

Head with the interocular space approximately half width of head, occiput smoothly rounded, frontal tubercles well marked with a median depression above, a narrow carina down lower front. Antennae in the male longer than half the body, third joint short and compressed, not so long as second, fourth joint very long and slender, fifth joint wider, sixth, seventh, eighth, much widened, ninth to eleventh gradually diminishing in width, entirely dark piceous. Prothorax only a little wider than long with the sides only slightly curved, a faint transverse depression, surface shining, pale yellow with a broad piceous vitta on each side. Scutellum pale. Elytra rather depressed, a small basal callosity with an intrahumeral sulcus, surface shining, finely and moderately densely punctate, pale yellow brown with a broad piceous vitta extending nearly across the elytra, leaving only a narrow pale vitta at the suture and the lateral margin pale. Body beneath pale yellow brown with the tibiae and tarsi a little darker, anterior tibiae in male enlarged, middle tibiae in male deeply excised, anterior coxal cavities open, claws appendiculate. Length 3.5 mm.; width 1.4 mm.

Type, male, USNM 66850, collected at Tegucigalpa, Honduras, July 9, 1918, by F. J. Dyer, at 5400 ft. altitude.

Remarks: The color pattern is similar to *Phyllecthrus gentilis* Leconte, but the enlarged antennal joints (in this case the intermediate instead of the terminal joints) and deeply excised middle tibiae in the male are like those of *Luperosoma marginatum* Jacoby and *L. nigrum* Blake, both from South America.

***Luperosoma nigricolle*, new species**

FIGURE 21

About 3 mm. in length, oblong oval, shining, entirely dark piceous, the antennae with thickened apical joints in the male (no female examined) and excised middle tibiae, elytra rather rugosely punctate.

Head with the interocular space approximately half width of head, occiput smooth, shining, with few punctures, the frontal tubercles swollen, lower front short, a short carina, entirely dark piceous. Antennae not extending to the middle of the elytra, third joint not so long as second, fourth the longest, remainder gradually decreasing in length and the four apical joints short and broad, deep brown. Prothorax only a bit wider than long with nearly straight sides, slightly depressed in the basal half, shining, impunctate, piceous. Scutellum piceous. Elytra a little depressed, with a short intrahumeral sulcus, rather coarsely and rugosely punctate, shining dark piceous. Body beneath entirely dark, frontal cavities open, claws appendiculate. Length 3 mm.; width 1.5 mm.

Type, male, CAS, from Coyote Cove, Conception Bay, Lower California, collected Oct. 1, 1941, by Ross and Bohart.

Remarks: Only a single male so far is known. It differs from the North American species of *Luperosoma* in having a dark instead of a pale pronotum.

***Luperosoma parvulum* (Jacoby)**

FIGURE 20

Luperus parvulus Jacoby, *in* Godman and Salvin, Biologia Centrali-Americana, Coleoptera, vol. 6, pt. 1, p. 597, 1888.

Between 2.5 and 3 mm. in length, elongate oblong oval, very shiny, the prothorax very finely and the elytra more distinctly and thickly punctate, the punctures becoming invisible on the sides and near apex, deep bluish black, the antennae and legs deep brownish piceous, in the male the middle tibiae excised and the last two joints of the antennae thickened, prothorax without visible depression on the disc.

Head with interocular space about half width of head, frontal tubercles swollen and a transverse depression over them, carina broad and flattish, lower front entirely dark, shining. Antennae extending to the middle of the elytra, the three basal joints dark reddish brown, remainder covered with pale pubescence and possibly a little darker. Second joint a little longer than third, fourth joint about equal to second and third together, rest subequal, gradually widening so that the tenth and eleventh joints are quite heavy. Prothorax only a little wider than long with slightly curved sides, not at all depressed although not very convex, but smoothly rounded, surface very finely punctate becoming more densely and distinctly punctate near the bottom, entirely shiny dark bluish black. Scutellum dark. Elytra narrowly elongate, smooth with a short intrahumeral sulcus, strongly punctate along the suture, in the base with transverse wrinkles near the suture, punctation tending to be striate and becoming evanescent on sides and below the middle; shining dark blue.

Body beneath dark (hidden by the glue on which it is stuck to a card); middle tibiae of the male excised near the apex. Length 2.8 mm; width 1.3 mm.

Type, male, MCZ, from Guanajuato, Mexico, Sallé collector.

Remarks: This is another of the species with excised middle tibiae and with the terminal joints of the antennae enlarged in the male. It differs from the others of the genus *Luperosoma* in that the prothorax is not at all depressed, in this respect resembling the species of the West Indian genus *Ectmesopus*. In fact, except for the locality of Mexico, there is little to differentiate this from the West Indian genus.

***Platymorpha centromaculata* (Jacoby)**

FIGURE 9

Malacorhinus centromaculatus Jacoby, *in* Godman and Salvin, Biologia Centrali-Americana, Coleoptera, vol. 6, pt. 1, p. 590, 1888.

About 7 mm. in length, elongate oblong oval, not at all shiny, dull alutaceous, the elytra densely but not coarsely punctate, the prothorax faintly depressed in the lower half, pale yellow brown, on the elytra 2 piceous spots below the middle and a faint trace of spotting near the base in middle, the femora dark streaked, tibiae, tarsi, and antennae dark.

Head with interocular space more than half width of head, a median depressed line down the occiput and a depression over the frontal tubercles, alutaceous with a few punctures on the occiput, carina short, front short. Antennae extending to the middle of the elytra, piceous with the terminal three joints a little paler brown, second and third joints short. Prothorax with the sides only slightly curved and with a very faint depression in the basal half, alutaceous, the punctation distinct on the ridges on the sides, entirely pale yellow brown. Scutellum pale. Elytra alutaceous, rather densely and finely punctate, pale yellow brown, each elytron having a piceous spot below the middle, and a very faint trace of a spot in middle near the base. Body beneath pale with the breast a shade darker and the femora pale with a dark outer streak, tibiae and tarsi dark, claws appendiculate. Length 7 mm.; width 3.3 mm.

Type, female, MCZ, from Capetillo, Guatemala, Champion collector.

Remarks: Jacoby put this species "provisionally" in the genus *Malacorhinus* but wrote that it differs from the others in the "more transversely shaped and not posteriorly constricted thorax and in the longer metatarsus of the posterior legs." The short third antennal joint, the shape of the prothorax with its very faint depression, the coloring of the whole beetle, together with its alutaceous surface, all resemble species of *Platymorpha*. Jacoby had at least one

more specimen which was collected at Tepanistlahuaca, Mexico, by Sallé and is now probably in the British Museum. He also writes of a variety without spots. There is in the U.S. National Museum collection a specimen from Yepocapa, Guatemala, that may be the male of Jacoby's *centromaculatus*. It has, however, an additional pair of spots in the basal half of the elytra. On the other hand, it does not entirely correspond with Jacoby's description of the variety of *Platymorpha variegata* because there is no humeral dark spot, and in Jacoby's description no mention is made of median basal spots. One of the localities given by Jacoby for *variegata* is Capetillo, Guatemala, which is the same locality as that for *centromaculata*.

To J. A. Wilcox belongs the credit for noting that Jacoby's species doubtfully described as a species of *Malacorhinus* really belongs to *Platymorpha*.

***Platymorpha homoia*, new species**

FIGURE 4

About 6.5 mm. in length, elongate oblong oval, feebly shining, alutaceous, the elytra finely punctate, the pronotum with a shallow, not very conspicuous transverse depression, the head in the male with a somewhat depressed lower front in the middle of which above the labrum protrudes a bifid spine, antennae with the second and third joints very short and compressed in the male, the remainder long, heavy and triangular at apex; pale yellowish brown with dark antennae, dark tibiae and tarsi, the femora with a dark streak at the apex, in the male the first tarsal joint and front tibiae much dilated, the middle tibiae excised near the apex.

Head with the interocular space a little more than half width of head, occiput alutaceous and finely punctate, a median depression over the frontal tubercles, carina short, below this the lower front shallowly depressed, with the labrum produced somewhat horizontally and right over it in the middle a bifid spine; all pale yellowish brown. Antennae long and dark and wide, the second and third joints short and compressed, the two terminal joints lacking. Prothorax with the lateral explanate margin visible from above its entire length and at apex slightly toothed; the transverse sulcus not very conspicuous but a shallow depression; surface alutaceous, finely punctate, entirely pale. Scutellum pale. Elytra alutaceous and finely punctate, entirely pale, except for a very faint median brown spot below the middle on each elytron. Body beneath entirely pale, femora pale with a dark streak, tibiae and tarsi dark. In the male the front tibiae widened near the apex and the first tarsal joint nearly globular above, the underside slightly concave; middle tibiae with a barely perceptible notch, very shallowly excised near the apex; first tarsal joint of hindlegs long and

slender, anterior coxal cavities open, claws appendiculate, a spine on middle and hind tibiae. Length 8.5 mm.; width 2.7 mm.

Type, male, USNM 66854, from Mauricio, Guatemala, collected in May 1891, by G. W. Bock, from the Knab collection.

Remarks: With the exception of the specimens of *Platymorpha smaragdipennis* Jacoby all the others of this genus that I have examined may possibly be of one species, since in general shape they are all very similar, although the variation in color and spotting is considerable. Jacoby described *P. variegata* as having the elytra black, and described as a variety of that two specimens with pale fulvous elytra having a small black spot placed on the shoulder and a more transversely shaped spot at the middle. The present species differs from the spotted variety in being pale yellow brown, and not at all reddish brown, with only a trace of a spot behind the middle on each elytron. Jacoby did not mention another male character, the median spine on the lower front of the face.

Romanita amazonica Bechyne

FIGURE 31

Romanita amazonica Bechyne, Ark. Zool., vol. 11, p. 136, 1958.

About 5 mm. in length, oblong oval, somewhat shiny, distinctly punctate, the head, elytra, breast, abdomen and legs entirely dark piceous, antennal joints four to seven piceous, basal joints partly dark, four terminal joints pale yellow; thorax pale, middle tibiae of the male excised near apex, and third antennal joint compressed.

Head with the interocular space half width of head, occiput smooth, alutaceous, very finely punctate, frontal tubercles distinct, smooth, carina short, disappearing in the rather swollen lower front, head entirely piceous. Antennae very hairy, second and third joints short, remainder very long, the last four joints pale yellow. Prothorax with the sides slightly rounded, wider than long, a distinct transverse sulcus, alutaceous and rather coarsely punctate. Scutellum dark. Elytra wider towards apex with a moderately wide explanate margin, entirely piceous, shining, a short intrahumeral sulcus, finely punctate with a faint trace of a postmedian depression. Body beneath with the breast, abdomen, and legs entirely piceous; anterior coxal cavities open, a spine on middle and hind tibiae, the middle tibiae with a small excision near apex in the male, claws appendiculate, the first tarsal joint long. Length 5 mm.; width 2.5 mm.

Type, in Naturhistoriska Riksmuseet, Stockholm, Sweden, and a paratype, a male, in Frey Museum, Tutzing bei Munich, Germany, both from Rio Uaupes, Taracúa, Rio Negro, from S. Gabriel, Roman expedition.

Remarks: The long slender antennae with the short compressed third joint in the male, the front of the head that is slightly bulging and without any spine, and the rather short prothorax differentiate this genus from the Central American genus *Platymorpha*, in which the antennae are stouter, there is a spine on the lower front of the face, and the prothorax is longer.

Romanita vittata Bechyne

FIGURE 28

Romanita vittata Bechyne, Ark. Zool., vol. 11, p. 137, 1958.

About 4.5 mm. in length, elongate oblong oval, the antennae missing, the prothorax smooth and without any transverse depression, elytra with a slight depression below basal callosity and another below the middle, finely punctate with a tendency towards being striate; pale yellow brown with the occiput of the head dark, three dark pronotal vittae, the middle one the widest, and a wide vitta on each elytron covering more than half of each, breast brownish.

Head with the interocular space about half width of head, occiput rounded, frontal tubercles distinct, carina short ending in a slightly swollen ridge below the antennal sockets; pale yellow brown with the mouthparts brownish. Antennae missing, but said by Bechyne to be like those of *R. amazonica*. Prothorax wider than long with slightly curved sides and without any transverse sulcus visible to me although Bechyne stated it was "feebly impressed"; shiny pale yellow with a wide median vitta and a narrower one on each side. Scutellum dark. Eyltra narrow, elongate, with a slight basal callosity and a depression below, and also another transverse impression below the middle, punctation fine, tending to be striate; pale yellow brown with a wide piceous vitta on each elytron beginning at the humerus and widening gradually towards apex but not extending to the suture, the apex dark, lateral margin pale, epipleura vanishing at apical curve. Body beneath pale with the breast brownish, the femora pale with a dark streak above, tibiae and tarsi brownish, a spine on hind tibiae, ? on others, claws appendiculate. Length 4.5 mm.; width 2 mm.

Type, female, in Naturhistoriska Riksmuseet, Stockholm, Sweden, from S. Gabriel, Roman expedition, collected on December 26.

Remarks: This female specimen with no antennae and without any discernible depression across the pronotum is without any characters by which it can be definitely placed in the genus *Romanita*.

Romanita ornata Bechyne

FIGURE 34

Romanita ornata Bechyne, Ark. Zool., vol. 11, p. 136, 1958.

About 7 mm. in length, oblong oval, shining, the prothorax with a

shallow transverse sulcus not at all conspicuous, the elytra finely punctate, a little wrinkled and with faint costae; piceous, the prothorax pale, the body beneath except the breast pale, femora pale at base, a narrow pale fascia below the middle of elytra, not joined at suture, and a pale apical spot on each elytron.

Head with the interocular space about half width of head, the occiput polished and finely punctate, faint traces of frontal tubercles but flat, and a flat interantennal area without a carina swelling out below and widening; entirely dark. Antennae (in female) with the third joint a little longer than second, fourth joint considerably longer than second and third together and longer than the succeeding joints which are subequal, piceous with the three terminal joints pale yellow. Prothorax somewhat wider than long with nearly straight sides and with a very shallow transverse sulcus, scarcely visible; pale yellow, polished, nearly impunctate. Scutellum dark. Elytra obsoletely and rather rugosely punctate, and with traces of costae, shining piceous with a pale yellow fascia below the middle interrupted at the suture and somewhat depressed, a round pale spot also near the apex. Epipleura vanishing at apical curve. Body beneath pale except the dark breast, femora pale at base but dark in apical half, tibiae and tarsi dark. Anterior coxal cavities open, the claws appendiculate. Length 6.8 mm.; width 3 mm.

Type, female, in Naturhistoriska Riksmuseet, Stockholm, Sweden, collected on the Río Negro, S. Gabriel, Amazon, Roman expedition, January 5.

***?Romanita fasciata* (Weise)**

FIGURE 35

Neobrotica fasciata Weise, Ark. Zool., vol. 14, no. 1, p. 93, 1921.

About 8 mm. in length, elongate oblong oval, the elytra finely punctate, the punctures in the pale band coarser and more distinct, and with a suggestion of being geminate striate between feeble traces of costae, the transverse sulcus on the prothorax not marked; pale yellow brown, the head, antennae and legs piceous, elytra piceous with a broad pale band across the middle but interrupted at the suture, apex narrowly pale.

Head with the interocular space approximately half width of head, occiput polished, impunctate, frontal tubercles distinctly marked but not swollen, a median depression above them, a narrow, distinct carina down the lower front, entirely dark shiny piceous. Antennae with the third joint a little longer than the second, both together not so long as the fourth, rest a little shorter, long and slender, dark brown with the three terminal joints pale. Prothorax rectangular, almost twice as broad as long with slightly curved sides and

unusually shallow transverse depression more marked at the ends; very finely punctate, polished yellow brown. Scutellum yellow brown. Elytra with traces of lateral costae, finely punctate, in the dark part but in the broad pale median fascia which is also somewhat depressed, the punctation tending to be geminate striate and coarser; the fascia interrupted at suture, apex narrowly pale. Body beneath pale with the breast brownish, legs except coxae dark, anterior coxal cavities open, a spine at end of middle and hind tibiae, claws appendiculate. Length 8.2 mm.; width 3.8 mm.

Type, female, Naturhistoriska Riksmuseet, Stockholm, Sweden, collected at Manaos, on the Amazon, Brazil, by Roman.

Remarks: This is certainly not a species of *Neobrotica* as Weise has described it. Bechyne has stated that it is possible it may belong in his genus *Romanita*. Only a female is known, but it shows little resemblance to *Romanita amazonica* Bechyne, the genotype, except in the long fourth antennal joint. Whether the third joint in the male is short and compressed and the middle tibiae notched is impossible to determine at present. There is a depression behind the middle of the elytra, which is one of the characters that Bechyne gives for *Romanita*.

Porechontes, new genus

Type species: *Porechontes wilcoxi*, new species.

Elongate oblong oval, head with the lower front smooth and somewhat bulging, in the male a pore in the middle of the lower front below the antennal sockets. Antennae long, extending to the middle of the elytra, the third joint short and compressed in the male, fourth joint longer than the fifth joint, usually the eight and ninth joints a little wider or irregularly triangular in the male. Prothorax with a shallow, scooped-out depression in the basal half, sides rounded with the explanate margin visible from above. Elytra without depressions, confusedly punctate. Anterior coxal cavities open, middle tibiae in the male excised near the apex, first joint of hind tarsi long, claws appendiculate.

This genus differs from the genus *Romanita* as typified by *Romanita amazonica* Bechyne in the shape of the head with the pore in the middle of the lower face, in having the ninth and tenth antennal joints usually somewhat widened in the male, and by the narrower prothorax and lack of any depression behind the middle of the elytra. It is distinguished from *Platymorpha* by the shape of the head which instead of having a spine over the labrum and a short carina, has a long somewhat bulging lower front with a pore below the antennal sockets. *Platymorpha albiventris* Blake (Proc. U.S. Nat. Mus., vol. 108, p. 99, 1958) belongs in this genus. At the time I described the

species none other had been seen and I tentatively included it in *Platymorpha* stating that it was not closely related to the other species.

The name *Porechontes* is derived from the Greek πόρος, meaning "pore," and ἔχοντες, meaning "having."

***Porechontes wilcoxi*, new species**

FIGURE 29

Between 3 and 4.5 mm. in length, oblong oval, shining, elytra finely punctate, in the male the middle tibiae slightly notched and the third antennal joint short and compressed, in the female the third joint a little longer than the second, remaining joints long, in the male the ninth and tenth joints somewhat dilated; yellow brown with the occiput of the head and mouthparts piceous, pronotum more than half piceous, pale along the base, elytra piceous with the margin and a wide vitta common to both elytra along the suture and widened near the apex into a roundish area, pale, the abdomen and base of femora and ninth and tenth antennal joints pale.

Head with the interocular space about half width of head, occiput smoothly rounded, polished, finely punctate, dark to the antennal sockets, frontal tubercles clearly marked, lower front pale, bulging out so that the carina is not apparent, a pore in the middle of the front of the male; mouthparts dark. Antennae with the third joint short and compressed in the male, a little longer in the female, remainder long, dark, hairy except the ninth and tenth joints which are pale and in the male slightly wider. Prothorax about one-third wider than long with the sides only slightly rounded, a broad scooped-out depression in lower half; surface shining, very finely punctate; piceous except for the pale margin and pale basal fascia. Scutellum shining piceous. Elytra rather flat with wide explanate margin, small humeri, shiny; shallowly punctate, piceous with wide pale margin on the sides and wide pale sutural vitta beginning below the scutellum and widening in a roundish apical area before apex. Body beneath pale with the breast dark, the femora dark in apical half, tibiae and tarsi dark, anterior tibiae thickened in male and the middle tibiae with a barely perceptible notch; anterior coxal cavities open, claws appendiculate. Length 3–4.5 mm.; width 1.7–2.3 mm.

Type, male, MCZ 30676; 14 paratypes, of which 4 are in the U.S. National Museum, from Barro Colorado Island, Canal Zone, collected June 23, 1924 by Nathan Banks. Other specimens from Tabernella, Cobima, Canal Zone, collected by A. Busck.

Remarks: This species closely resembles the two following in size and shape and in having the ninth and tenth joints of the antennae in the male slightly dilated and a pore in the middle of the front of

the face. As in *Romanita amazonica* and the species of *Platymorpha* the third antennal joint in the male is compressed.

Porechontes limbella (Weise)

FIGURE 30

Chhoneis limbella Weise, Ark. Zool., vol. 14, no. 1, pp. 103–104, 1921.

About 4 mm. in length, elongate oblong oval, shining, the pronotum punctate along the base, the elytra strongly and a little rugosely punctate, the occiput of head, tip of abdomen, elytra (except lateral margin), legs more or less piceous, the lower front of head and base of femora deep brown, prothorax and body beneath pale, the antennae with the three terminal joints pale, ninth joint in male widened and middle tibiae excised.

Head with the interocular space half width of head, occiput finely punctate, frontal tubercles somewhat swollen and a narrow carina that is lost in the somewhat swollen and smooth lower front, that is paler than the dark occiput and rather densely punctate, in the male a deep pore in middle below the antennal sockets, eyes large and rather bulging. Antennae long, slender and hairy, extending beyond the middle of the elytra, in the male the third joint shorter than the second and cup shaped, and the ninth widening in a triangular shape towards apex, basal joints yellowish brown, terminal three joints pale yellow with the apex of the last dark. Prothorax with the sides slightly curved, a scooped-out depression in lower half, surface shiny and distinctly punctate along anterior and basal margin but not in the depression, entirely pale. Scutellum dark brown. Elytra smooth, without depressions except the short intrahumeral one, rather densely and somewhat rugosely punctate, piceous with the pale margin along the sides becoming brownish at apex. Body beneath pale yellow with the tip of the abdomen dark, the femora at base pale brown, becoming piceous outwardly, tibiae and tarsi piceous, middle tibiae of the male notched, anterior coxal cavities open, claws appendiculate, no spine discernible on the tibiae. Length 4 mm.; width 2.2 mm.

Type, male, in Riksmuseum, Stockholm, Sweden, from Rio Purus, Amazon, Roman collector.

Remarks: This is closely related to *Porechontes albiventris* (Blake).

Simopsis, new genus

Type species: *Simopsis neobroticoides*, new species.

Elongate oblong oval, head with the face rather flat, only a trace of a carina and the frontal tubercles only outlined. Antennae in the male with the third joint short and compressed, the fourth joint longest of all, and joints four to eight somewhat thicker than the rest. Pro-

thorax faintly depressed in the basal half and with rounded sides and explanate margin. Elytra wider apically and somewhat costate, the punctation confused and rugose. Anterior coxal cavities open, middle tibiae in the male excised, first tarsal joint of hindlegs longer than the rest together, claws appendiculate.

This genus has been erected for a beetle that does not fit into any genus although closely resembling the genera *Platymorpha*, *Romanita*, and *Porechontes* in having in the male a short, compressed third antennal joint. It differs from all of them in general shape as well as in having a different face without any spine or pore or swollen lower front. Superficially it resembles species of *Neobrotica* in its markings and somewhat costate elytra, but does not belong in this genus because of its excised middle tibiae and short third antennal joint.

The name *Simopsis* is derived from the Greek σιμός, meaning "flat nosed," and ὄψις, meaning "face."

***Simopsis neobroticoides*, new species**

FIGURE 24

About 5 mm. in length, oblong oval, shiny, the prothorax feebly depressed in basal half, the elytra somewhat costate and with rugose punctation, pale yellow brown with a piceous head and piceous markings at base and apex of elytra, the breast dark, the middle tibiae in the male excised and the intermediate antennal joints a little widened.

Head with the interocular space half width of head, occiput smoothly rounded, a faint depression over the obscure frontal tubercles, and on each side near the eye a deep fovea, lower front rather flat with an inconspicuous carina, dark piceous except the neck and the palpi which are yellow. Antennae extending to the middle of the elytra, joints four to eight deeper brown and in the male a little widened, the third joint short and compressed, the fourth joint longer than the rest. Prothorax with rounded sides and feebly depressed in the lower half, shining, pale yellowish brown. Scutellum bicolored. Elytra wider towards apex, feebly costate along the sides and with coarse rugose punctation, pale yellowish brown with piceous basal markings covering humerus and extending down the side and middle a quarter the length of the elytra, other piceous markings at the apex consisting of two spots, more or less joined, on each elytron. Body beneath pale with the breast dark, legs entirely pale, anterior tibiae and first tarsal joint in the male swollen, middle tibiae excised near the apex. Anterior coxal cavities open, claws appendiculate. Length 5 mm.; width 2.5 mm.

Type, male, BMNH, from Rio Purus, Amazon region, taken in October 1874.

Remarks: In general shape, color, and markings this strongly resembles a species of *Neobrotica*.

***Oroetes wilcoxi*, new species**

FIGURE 18

About 6 mm. in length, elongate oblong oval, shining, very minutely punctate, the male with the face excavated, antennal joints only ten in number, the third and fourth antennal joints excavated near the end, and the pronotum with a median knob anteriorly, none of these abnormalities present in the head, antennae, or pronotum of the female; pale yellow brown with dark brown antennae in the female and pale yellow brown, except basal joint, in the male, elytra with basal third yellow brown, the rest deep violet.

Head with interocular space more than half width of head, in female smoothly rounded over the occiput, polished, the lower front flat, paler yellow, without trace of carina or tubercles, in the male the lower front below the antennal sockets hollowed out with a flattish oval side piece extending from the antennal sockets to labrum, the mouthparts yellowish brown. Antennae 10-jointed in male, the first joint robust, very swollen, second short, third short, excavated at the end, fourth longer than basal joint with a cutout incision near the basal end, remaining joints long and becoming more slender towards apical joint, terminal joint very elongate and deeper brown, the rest yellowish. In the female the basal joint more slender, second and third joints short and about equal, remainder long and a little more slender than in the male. Prothorax wider than long with slightly rounded sides and a scooped-out depression in the basal half, in the male a prominence on either side anteriorly and the anterior margin produced a little in the middle with a knoblike swelling having a small hole in it and setae about the edges; in the female the side humps less developed and no such median knob; shiny pale yellow. Scutellum pale yellow. Elytra wider behind the middle with small humeral prominences and wide explanate margin, shiny, very finely punctate, pale yellow in basal third, the remainder of elytra deep violet. Epipleura not extending much beyond the middle; body beneath and legs entirely yellow, the middle tibiae of the male notched near the apex, all tibiae with a tiny spine; anterior tibiae in the male stouter, and the first tarsal joint enlarged and cylindrical; claws appendiculate, anterior coxal cavities open. Length 5.5–7.5 mm.; width 2.5–3 mm.

Type, male, USNM 66852, and 1 female paratype, both from Rurrenabaque, Rio Beni, Bolivia, collected October 1921 by W. M. Mann.

Remarks: This species is the second of the genus to be described. *Oroetes flavicollis* Jacoby was described from specimens from Chon-

tales, Nicaragua, and Bugaba and David, Panama. In the present species the elytra instead of being entirely deep violaceous are violaceous with the basal third pale yellow. Also in the structure of the male antennae the third and fourth joints are a little differently formed, with a smaller round incision near the apical and basal ends of the joints. Otherwise the two species bear a strong resemblance to each other in spite of the widely separated regions in which they were collected. Like *Phyllecthrus*, both species have only ten joints in the male antennae. John A. Wilcox unearthed the specimens in the U.S. National Museum collection and has generously handed them over to me to describe.

***Deuterobrotica atlanta* (Bechyne)**

FIGURE 25

Neobrotica atlanta Bechyne, Ent. Arb. Mus. G. Frey, vol. 7, p. 318, 1950.

Deuterobrotica atlanta (Bechyne).—Bechyne, Ent. Arb. Mus. G. Frey, vol. 9, p. 596, 1958.

About 5 mm. in length, oblong oval, shining, the elytra rather coarsely punctate, antennae in the male with the terminal joints enlarged and the middle tibiae excised near the apex. Head and prothorax tan colored, head with a short dark piceous mark on either side of the tan-colored occiput, elytra piceous with pale margins and suture and a short incurving pale vitta on each elytron, body beneath and legs except coxae black.

Head with the interocular space more than half width of head, occiput rounded, frontal tubercles swollen, a slight depression over them, a very short carina and a rather long lower front, pale except for two piceous marks at the base of the occiput. Antennae in male with the last three joints somewhat enlarged, third joint shorter than fourth, entirely dark. Prothorax nearly rectangular, the explanate margin visible from above entire length; very shiny with the transverse sulcus shallow and not conspicuous except at the ends. Scutellum pale. Elytra piceous, the margin and suture pale yellow and a short incurving pale vitta extending down from the intrahumeral sulcus and not reaching the middle of the elytron. Body beneath and legs except coxae dark. Coxal cavities open, claws appendiculate, middle tibiae of the male with a small notch. Length 5.5 mm.

Type, male, in G. Frey Museum, Tutzing bei München, Germany, collected at Nova Teutonia, St. Catarina, Brazil, Nov. 5, 1950, F. Plaumann collector.

Remarks: Bechyne has described the genus *Deuterobrotica* as having the terminal joints of the antennae in the male enlarged and the pronotum with seta-bearing punctures on the side. He did not note the excised middle tibiae in the male.

***Deuterobrotica bechynei*, new name**

FIGURE 22

Neobrotica lineigera Bechyne (not Bechyne 1956, not Jacoby 1887), Ent. Arb. G. Frey Mus., vol. 9, no. 2, p. 600, 1958.

About 6 mm. in length, oblong oval, shining, the elytra with rather rugose punctation, pale with dark antennae and legs and dark undersurface, two small dark spots at base of head and dark elytra having a pale sutural vitta and a pale median vitta extending to apical curve and a pale margin.

Head with the interocular space more than half its width, occiput broad, a shallow depression above the well-marked tubercles, carina very short, barely reaching below the antennal sockets; occiput tan colored with two small dark vittate spots on either side of base, the front becoming paler, labrum piceous. Antennae long and slender and entirely dark in female. Prothorax approximately twice as broad as long with the lateral margin visible its entire length when viewed from above, the sides nearly straight, the transverse sulcus well marked, entirely pale. Scutellum reddish brown. Elytra alutaceous, but shiny, with large dense shallow punctures forming somewhat short rugose transverse ridges; pale yellow with a wide piceous lateral vitta united three-quarters of the way down with a broad median vitta of irregular shape, the margin and suture being pale. Body beneath and legs entirely dark except the pale trochanters; anterior coxal cavities open, claws appendiculate. Length 5.8 mm.

Type, female, from Santa Catarina, Brazil, in G. Frey Museum, Tutzing bei München, Germany.

Remarks: Bechyne has described two different species under the name *Neobrotica lineigera* within two years of each other. The second species was published in 1958. Jacoby has already described a *Neobrotica linigera* in 1887 (Biol. Cent. Amer. Coleopt., vol. 6, pt. 1, p. 574, 1887), a quite different species from either of Bechyne's two *lineigeras*. The name *lineigera* is essentially the same as *linigera* and according to the rules of zoological nomenclature, art. 58, no. 2, it should not stand as distinct. Therefore I am renaming the first species of Bechyne's as *Neobrotica atrilineata*, which is a manuscript name attached by Bowditch to specimens of this species. The second species described by Bechyne in 1958 (Ent. Arb. vol. 9, no. 2, p. 600, 1958), from a female specimen which is not a *Neobrotica* but a *Deuterobrotica*, I am naming *D. bechynei*.

Bechyne in keying out this species distinguishes it and *Neobrotica latifrons* from *Deuterobrotica amplicornis* by the fact that the terminal joints of the antennae are not thickened. He overlooks the fact that both *latifrons* and *bechynei* were described from single females, and the

male alone in this genus shows the thickening of the antennal joints. All three species occur in the same region, are congeneric and very closely related. Undoubtedly the males of both *latifrons* and *bechynei* have thickened antennal joints and the middle tibiae are excised near the apex.

***Deuterobrotica latifrons* (Bechyne)**

FIGURE 26

Neobrotica latifrons Bechyne, Ent. Arb. Mus. G. Frey, vol. 9, no. 2, p. 600, 1958.

About 6 mm. in length, elongate oblong oval, shiny, faintly alutaceous, sparsely but distinctly punctate, pale yellow, the prothorax with a broad anterior piceous spot on each side, each elytron with two piceous vittae not reaching the apex, one lateral, the other median. Antennae dark brown, tibiae and tarsi dark.

Head with the interocular space more than half width of head, occiput smoothly rounded, nearly impunctate, tubercles distinct, carina broad and rather flat, lower front short. Antennae long, slender, deep reddish brown, third joint shorter than fourth. Prothorax about one-third wider than long, with the lateral explanate margin visible from above all the way, the pores of this margin of which Dr. Bechyne writes not visible in the British Museum specimen although seen in the type in the Frey Museum; surface shining, finely punctate, a broad shallow transverse sulcus, pale yellow with a broad piceous area extending from the anterior margin to the sulcus and a little farther along the side but not reaching the middle on either side. Scutellum pale. Elytra with three faint costae on outer half of each elytron, finely and rather sparsely punctate, pale yellow with a median piceous vitta, wider near the base, and a lateral vitta from the humerus to apical curve, wider at the apical curve. Body beneath pale, shiny, not pubescent, anterior coxal cavities open, femora pale, tibiae and tarsi dark, claws appendiculate. Length 5.7–6 mm.; width 2.8 mm.

Type, female, in G. Frey Museum, Tutzing bei München, Germany, from Santa Catarina, Brazil. A second specimen, also a female, in the British Museum, from the same locality is a better specimen than the type which appears to be immature with the elytra and abdomen shrunken. In the British Museum specimen the elytra are clearly but sparsely punctate.

Remarks: The British Museum specimen bears the label "♀? *amplicornis*." It is not *D. amplicornis* but a closely related species with slightly different pronotal markings, in that the dark areas do not extend to the base, and the elytral vittae are not joined at the apex. *Amplicornis* is also more coarsely punctate. I believe that the male will have excised middle tibiae and enlarged antennal segments.

Deinocladus, new genus

Type species: *Diabrotica pectinicornis* Baly.

Elongate oblong oval, the head with well-defined frontal tubercles and a prominent carina down the lower front. Antennae in the male with the third joint short and compressed, fourth joint very long, joints five to eight becoming gradually larger, usually with a spur on the outside, ninth joint much widened and lengthened, tenth joint usually not quite so wide but also deformed, eleventh joint long and slender. Prothorax with a lateral edge and a more or less transverse sulcus across the disc, narrow but distinct in two species and only apparent at the ends in the third species. Elytra a little wider in apical half, in all three species the elytra piceous with a transverse pale fascia or a large pale spot, the margin and apex pale. In one species the elytra feebly costate. Anterior coxal cavities open, legs long and slender, the middle tibiae in the male notched, first joint of the hindlegs longer than the remaining joints together. Claws bifid.

The unusual development of the antennae in the males of these beetles together with the excised middle tibiae sufficiently differentiate it from other genera. No female specimen of any of the three species has been examined.

The name *Deinocladus* is derived from the Greek δεινός, meaning "terrible," and κλάδος, meaning "branch."

Deinocladus pectinicornis (Baly)

FIGURE 16

Diabrotica pectinicornis Baly, Ent. Monthly Mag., vol. 25, p. 252, 1889; Trans. Ent. Soc. London, p. 15, 1890.

About 6 mm. in length, elongate oblong oval, shiny, the elytra rather finely but distinctly punctate with faint costae along sides, the intervals having a suggestion of geminate striate punctation, pale yellow with the head, antennae, except tenth joint, tibiae and tarsi, and two wide elytral bands piceous. Antennal joints in male with apical spurs on the outside gradually widening, ninth and tenth joints long, broad and distorted, terminal joint cylindrical and thin, legs long, middle tibiae of male excised; claws bifid.

Head with interocular space half width of head, entirely dark, shiny, finely alutaceous with coarse dense punctures about median line and depression on occiput, and a few finer scattered punctures on the sides. Frontal tubercles much swollen, lower front with a prominent carina down it, punctate on either side, lower front only moderately long, not so long as in many *Diabrotica*. Antennae of male very irregular, antennae of female unknown. In male the second and third joints compressed into short rounded segments, with the

third the shorter, fourth joint very long with a tooth at apex on outside, fifth, sixth, seventh and eighth joints with an increasingly long apical spur, ninth joint much thickened, broad and longer and with a peculiar constriction or notching at apical end, tenth joint not so thick as ninth, with a tooth near the base on the outer side. Terminal joint long, thin, and cylindrical. All joints except the tenth, which is pale, dark brown and very hairy. Prothorax not twice as broad as long, somewhat rectangular, with only slightly curved sides, a blunt tooth at each angle, a shallow depression on either side as if the ends of a transverse sulcus, surface alutaceous and distinctly punctate, pale yellow. Scutellum pale. Elytra widened somewhat towards apex, an intrahumeral depression, faintly costate laterally with distinct semistriate punctures between the ridges; surface alutaceous, pale yellow with two wide piceous bands, the basal one extending to the middle, and a broad apical one with a narrow pale yellow band between and a pale margin and apex. Body beneath shiny, pale brown, not pubescent, abdomen paler; femora pale, tibiae and tarsi brown. Anterior coxal cavities open, femora and tibiae long and slender, no spine on any of the tibiae, middle tibiae in the male excised near the apex. Front tibiae in the male somewhat thickened, and the first tarsal joint wide, claws bifid. Length 6 mm.

Type, male, BMNH from Cauca, Colombia. A second specimen, also a male, in the Bowditch collection, from "Bolivia."

Remarks: Baly wrote that he had two specimens, both males, one of which is in the British Museum, and the other one in the Bowditch collection, and these are the only specimens known to the writer. The bifid claws, the peculiar antennal formation in the male, the long slender legs, and the excised middle tibiae differentiate this from related genera.

***Deinocladus cartwrighti*, new species**

FIGURE 15

About 5 mm. in length, oblong oval, shining, the elytra confusedly punctate, the prothorax with a short median transverse sulcus, in the male the ninth and tenth antennal joints much enlarged and the middle tibiae excised, pale yellow brown with a piceous head and antennae, except the tenth and eleventh joints, brown breast and deep brown elytra having the margin and apex and a large median spot on each elytron pale.

Head with the interocular space half width of head, occiput shiny, smooth, finely punctate and with a median depression over the frontal tubercles, carina extending narrowly down the front, entirely piceous. Antennae in the male (female unknown) long and irregularly shaped, the second and third joints short and compressed, fourth joint long

with the apex prolonged on one side into a spur, fifth joint shorter and also spurred, sixth, seventh and eighth joints gradually thickening and wider at apex, ninth much thickened with a longitudinal cavity below, tenth also thick and pale, also with a long concavity beneath, eleventh joint long, slender and pale, also with the tip dark. Prothorax almost rectangular, the sides only slightly rounded, the explanate margin visible its entire length from above, a tooth at each angle; median transverse sulcus shorter and less pronounced than usual in *Neobrotica;* surface shining, finely punctate. Scutellum bicolored. Elytra with prominent humeri and short intrahumeral sulcus, densely and confusedly punctate, without costae, dark brown with pale margins and apex, and pale along the basal margin, a large median roundish pale spot on each elytron. Body beneath pale, the femora brownish, tibiae and tarsi dark; middle tibiae of male excised; anterior coxal cavities open, claws bifid. Length 4.8 mm.; width 2.2 mm.

Type, male, USNM 66851, collected at Turrialba, Costa Rica, May 25, 1951, by O. L. Cartwright.

Remarks: This species is closely allied to *D. pectinicornis* (Baly). The development of the antennal joints in the male is not quite so extreme but similar, the excision of the middle tibiae the same, and even the general color pattern very similar.

***Deinocladus fascicollis*, new species**

FIGURE 13

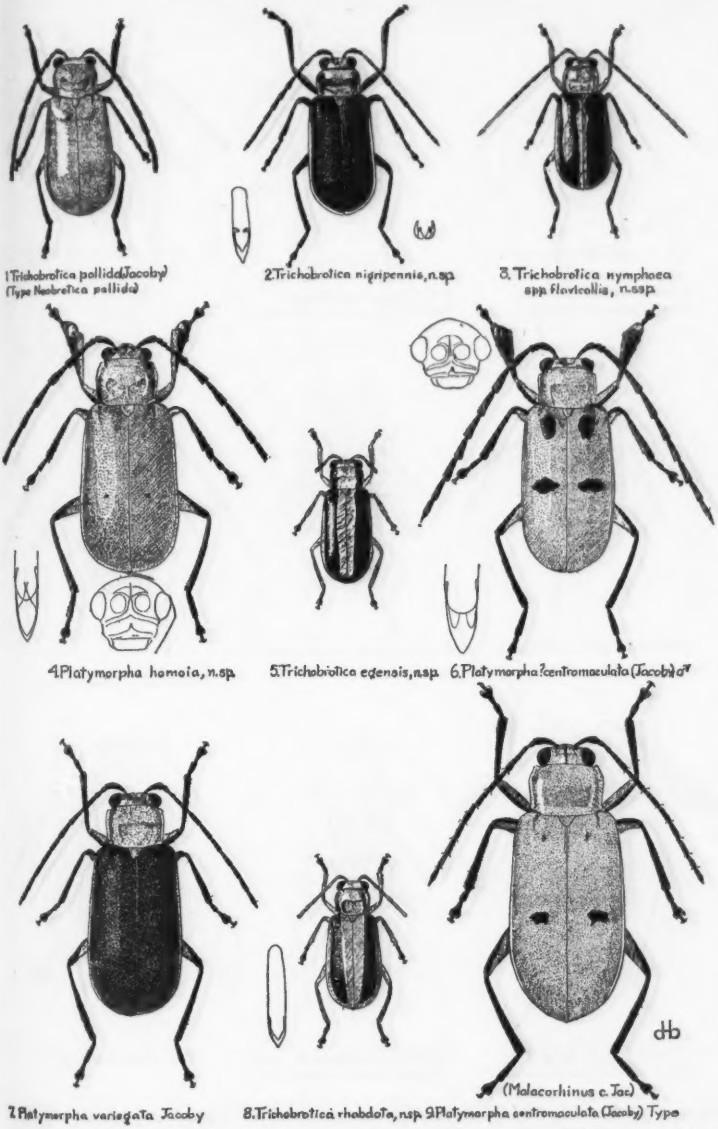
About 4 mm. in length. oblong oval, the pronotum with a transverse sulcus, elytra shallowly and densely punctate, yellow brown with a piceous head and antennae, a deep brown band across anterior half of pronotum, elytra with a basal and apical piceous fascia, tibiae and tarsi, breast and apex of abdomen piceous, in the male the antennal joints much enlarged and the middle tibiae excised.

Head with the interocular space about half width of head, occiput rounded without depressions, densely punctate, frontal tubercles well marked, a strong carina down lower front, on the sides punctate. Antennae in the male (female unknown) long and distorted, second and third joints very short, fourth joint as long as the first three together, fifth to eighth joints becoming gradually wider with a prolonged outer spur at apex, ninth joint long and much widened, tenth a little shorter and not so wide, eleventh long, narrow, all entirely dark. Prothorax almost rectangular with slightly curved sides, a transverse sulcus, surface distinctly punctate in places, shining yellow brown with a broad brown fascia across anterior half not reaching the side margins. Scutellum dark. Elytra broad towards apex, densely punctate, with a tendency to being striate, humeri with a short intrahumeral sulcus, yellow brown with a broad basal and apical

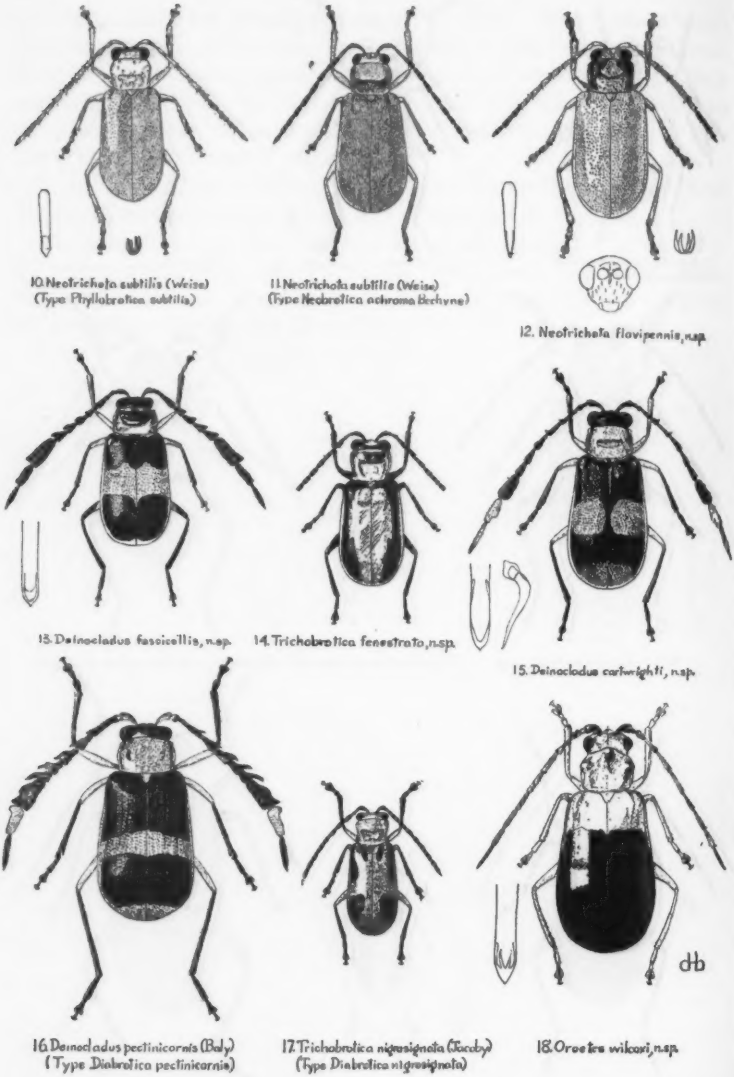
piceous fascia, not reaching margin or apex. Body beneath pale yellow with the breast and last segments of the abdomen piceous, anterior coxal cavities open, femora and tibiae slender, middle tibiae excised in the male, the femora pale except the hind ones which are dark at the apex, tibiae and tarsi dark, without spines, claws bifid. Length 4.2 mm.; width 2 mm.

Type, male, CAS, collected in the valley of the Rio Monzon, Tingo Maria, Peru, Oct. 9, 1954, by E. I. Schlinger and E. S. Ross.

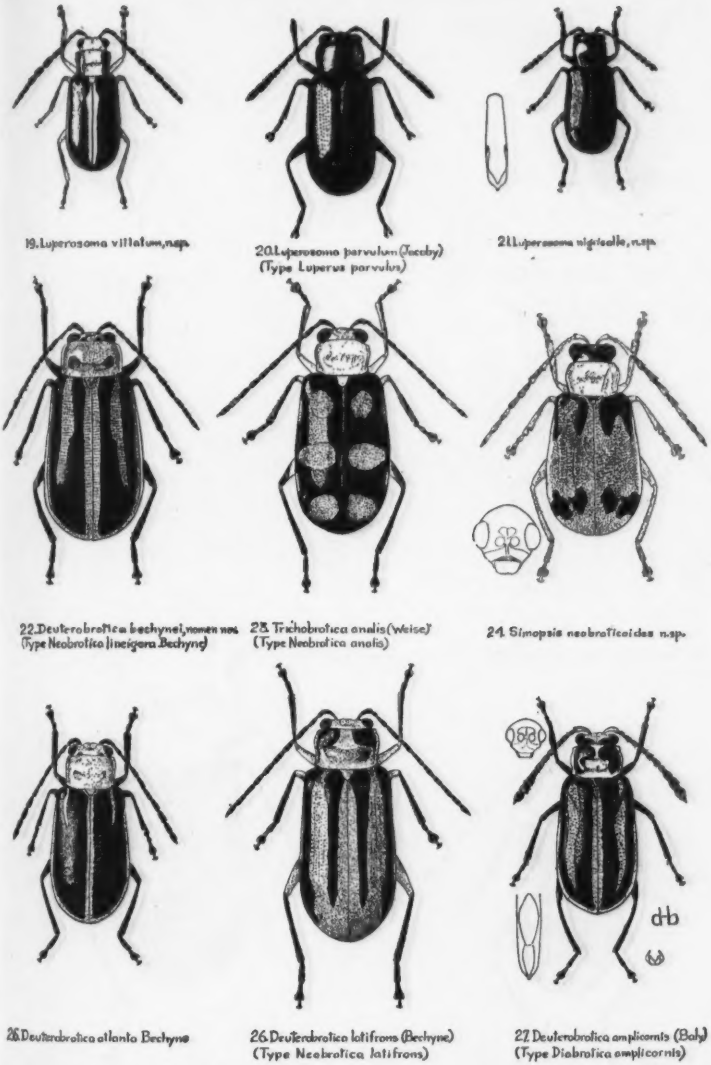
Remarks: This is the third species of the genus to be described. All three are known only from male specimens. All three have a similar yet different striking antennal development in the male, and all are with a similar elytral pattern.



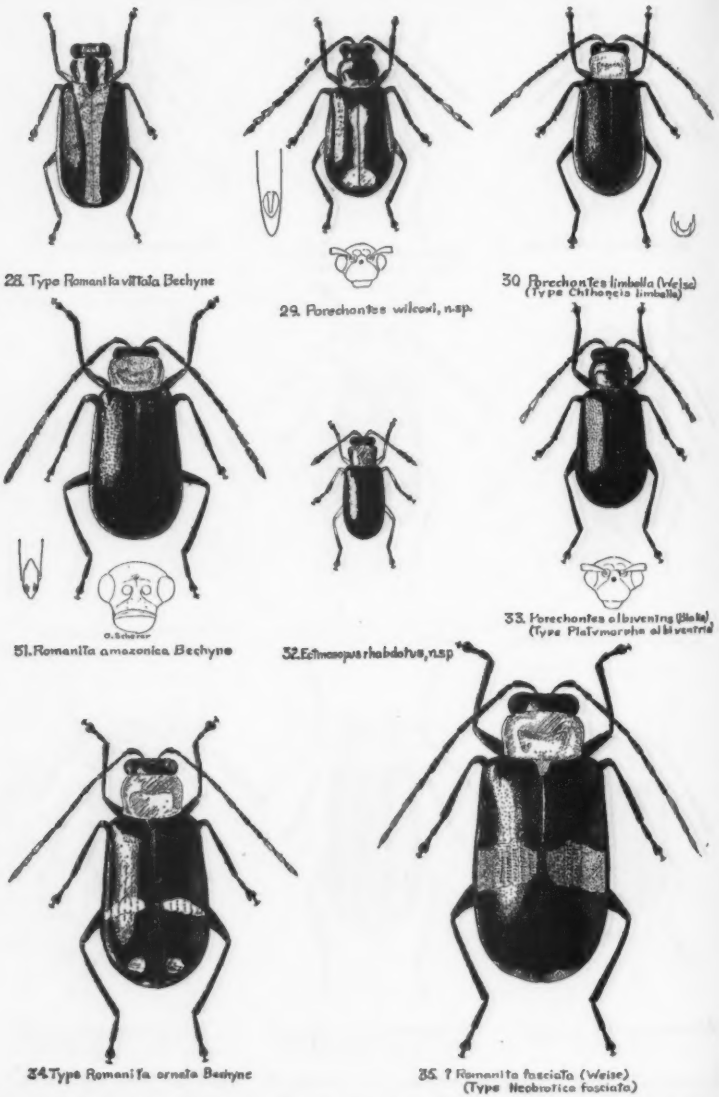
FIGURES 1–9.—1, *Trichobrotica pallida* (Jacoby) (type of *Neobrotica pallida*); 2, *Trichobrotica nigripennis*, new species; 3, *Trichobrotica nymphaea flavicollis*, new subspecies; 4, *Platymorpha homoia*, new species; 5, *Trichobrotica egensis*, new species; 6, *Platymorpha ?centromaculata* (Jacoby), male; 7, *Platymorpha variegata* Jacoby; 8, *Trichobrotica rhabdota*, new species; 9, *Platymorpha centromaculata* (Jacoby), type.



FIGURES 10–18.—10, *Neotrichota subtilis* (Weise) (type of *Phyllobrotica subtilis*); 11, *Neotrichota subtilis* (Weise) (type of *Neobrotica achroma* Bechyne); 12, *Neotrichota flavipennis*, new species; 13, *Deinocladus fascicollis*, new species; 14, *Trichobrotica fenestrata*, new species; 15, *Deinocladus cartwrighti*, new species; 16, *Deinocladus pectinicornis* (Baly) (type of *Diabrotica pectinicornis*); 17, *Trichobrotica nigrosignata* (Jacoby) (type of *Diabrotica nigrosignata*); 18, *Orootes wilcoxi*, new species.


19. Luperosoma vittatum, n.sp.
20. Luperosoma parvulum (Jacoby) (Type Luperus parvulus)
21. Luperosoma nigricolle, n.sp.
22. Deuterobrotica bechynei, nomen nov. (Type Neobrotica lineigera Bechyne)
23. Trichobrotica analis (Weise) (Type Neobrotica analis)
24. Simopsis neobroticoides n.sp.
25. Deuterobrotica atlanta Bechyne
26. Deuterobrotica latifrons (Bechyne) (Type Neobrotica latifrons)
27. Deuterobrotica amplicornis (Baly) (Type Diabrotica amplicornis)

FIGURES 19–27.—19, *Luperosoma vittatum*, new species; 20, *Luperosoma parvulum* (Jacoby) (type of *Luperus parvulus*); 21, *Luperosoma nigricolle*, new species; 22, *Deuterobrotica bechynei*, new name (type of *Neobrotica lineigera*); 23, *Trichobrotica analis* (Weise) (type of *Neobrotica analis*); 24, *Simopsis neobroticoides*, new species; 25, *Deuterobrotica atlanta* (Bechyne); 26, *Deuterobrotica latifrons* (Bechyne) (type of *Neobrotica latifrons*); 27, *Deuterobrotica amplicornis* (Baly) (type of *Diabrotica amplicornis*).


28. Type Romanita vittata Bechyne
29. Porechontes wilcoxi, n.sp.
30. Porechontes limbella (Weise) (Type Chthoneis limbella)
31. Romanita amazonica Bechyne
32. Ectmesopus rhabdotus, n.sp.
33. Porechontes albiventris (Blake) (Type Platymorpha albiventris)
34. Type Romanita ornata Bechyne
35. ? Romanita fasciata (Weise) (Type Neobrotica fasciata)

FIGURES 28–35.—28, *Romanita vittata* Bechyne; 29, *Porechontes wilcoxi*, new species; 30, *Porechontes limbella* (Weise) (type of *Chthoneis limbella*); 31, *Romanita amazonica* Bechyne; 32, *Ectmesopus rhabdotus*, new species; 33, *Porechontes albiventris* Blake (type of *Platymorpha albiventris*); 34, *Romanita ornata* Bechyne, type; 35, *Romanita fasciata* (Weise) (type of *Neobrotica fasciata*).

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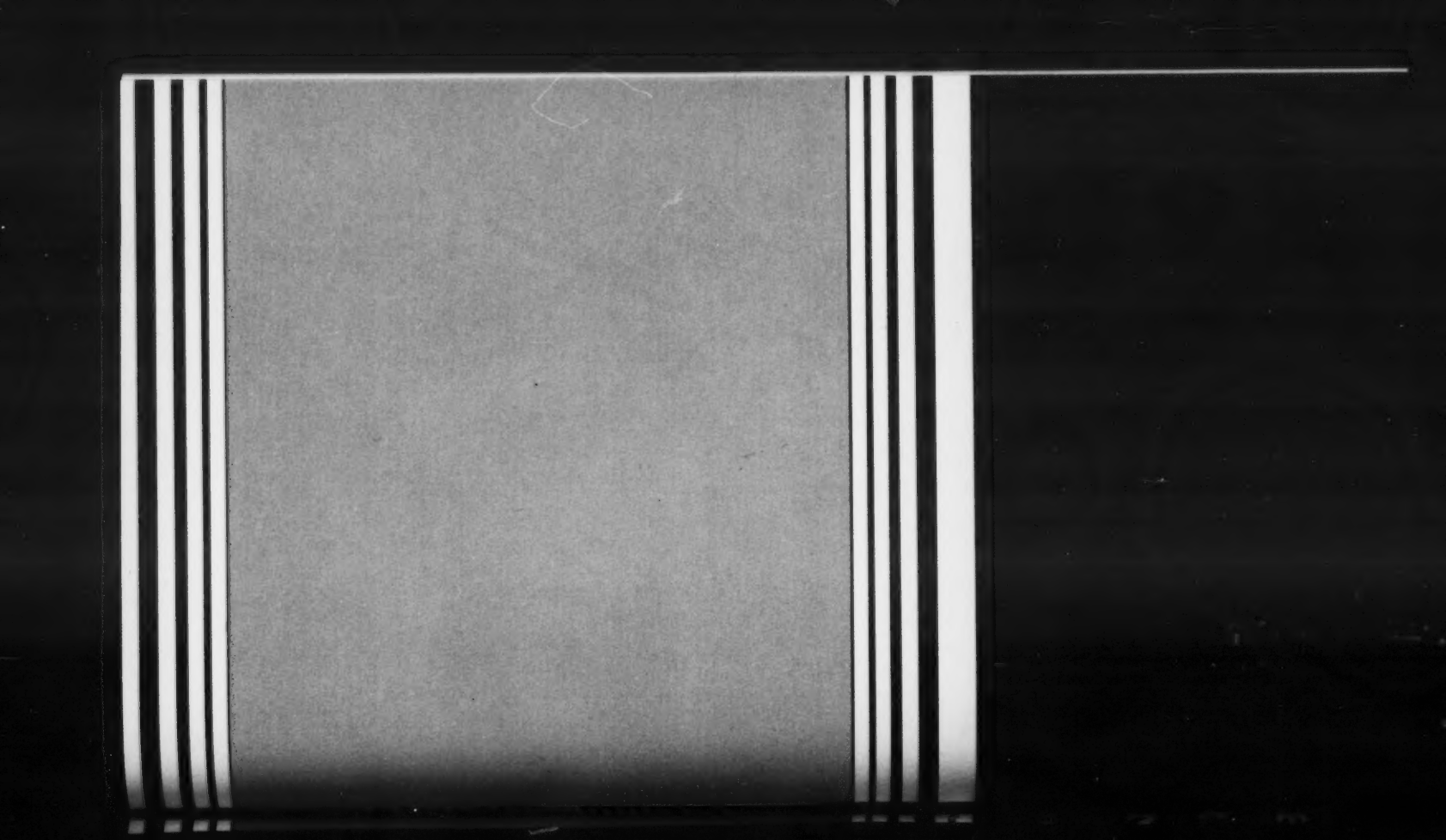

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By DORIS H. BLAKE

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A REVIEW OF THE BEETLES OF THE GENUS NEOBROTICA AND SOME CLOSELY RELATED GENERA

By DORIS H. BLAKE
Honorary Research Associate, Department of Entomology

The genus *Neobrotica* was first described by Jacoby in the "Biologia Centrali-Americana" (Coleoptera, vol. 6, pt. 1, p. 571, 1887), who listed under it 21 species. Only one of these, *Diabrotica oberthüri* Baly, had been described previously. In the supplement published in 1892, Jacoby added three more species from Central America. In 1889 he published two new species of *Neobrotica* from South America. Weise added three, Bowditch two, and recently Bechyne ten more, all from South America. One from the United States (Arizona) was described by Fall. A few older species of Olivier and Fabricius have also been added to the genus thereby doubling the original number.

In Schenkling's "Coleopterorum catalogus" (1924, pt. 78, p. 103), Weise has taken the first species described by Jacoby under *Neobrotica*—*N. variabilis*—as the type of the genus, a rather unfortunate choice as Jacoby in a later publication assigned to *variabilis* a South American beetle different from the Mexican *variabilis*.

In his description of the genus, Jacoby (loc. cit.) gave the following generic characters to differentiate *Neobrotica* from related genera:

Neobrotica has entirely the appearance and in many instances the elytral pattern of *Diabrotica*. It might be easily mistaken for that genus unless the claws are examined, these being appendiculate in *Neobrotica* (instead of bifid as in *Diabrotica*); with this character a deeply sulcate thorax is generally combined. Several species described here offer a striking instance of so-called "mimicry" in regard to colour and markings of the elytra (and indeed of the antennae also), and in this respect agree in every particular with some forms of *Diabrotica*. As I have in several cases both sexes before me, there can be no question of sexual differences in regard to the structure of the claws, etc. The genus will no doubt include some species at present referred to *Diabrotica* and *Cerotoma*.

It is inevitable that some of the species under Jacoby's rather broad and general classification of a transversely sulcate prothorax, appendiculate claws, and open anterior coxal cavities should not be very close to the genotype as typified by *N. variabilis*. In a previous paper (Proc. U.S. Nat. Mus., 1958, vol. 108, no. 3395, pp. 59–102) I have shown that *N. sexplagiata* and *N. ruatinae* belong with the Galerucine beetles that have excised middle tibiae in the male. Others, the types of which I had not seen at that time, notably *N. pallida* Jacoby and *N. analis* Weise, also belong in the excised middle tibiae group. And there are still other species of Jacoby's that do not easily fit into the genus and belong elsewhere, although it is true that they fulfill the generic requirements as stated by Jacoby. None of the species described by Weise are in *Neobrotica*, and two of Bechyne's, *N. latifrons* and *N. lineigera*, belong to *Deuterobrotica*, a genus that Bechyne himself described.

In *Neobrotica*, as I am restricting the genus, the antennae are always filiform; the third joint is almost as long as the fourth, never longer, and not different in the sexes; the front of the head is not hollowed out but with a carina more or less distinct down the front. The frontal tubercles are distinct and usually with a median depression above them. The prothorax has an explanate margin usually obscured from view anteriorly when viewed from above; the disc has a transverse sulcus curving across the basal half; the elytra usually have traces of costae, in some groups more developed than in others and occasionally there is no sign of costation. The punctation tends to be feebly striate in the more costate species. The anterior coxal cavities are open and the claws appendiculate. The legs are moderately long; in the male the front tibiae are frequently stout and the first tarsal joint of the front feet is somewhat enlarged, but not so dilated as in some species of *Cerotoma*. The first joint of the hind tarsus is very long. The aedeagus is not a distinguishing factor in separating the species, as it varies little.

In markings, the head is most frequently dark at least over the occiput; the pronotum is almost always without dark markings; the

elytral pattern in many species is similar and consists of a dark spot more or less lengthened over the humerus; a dark area about the scutellum extending along the suture a little way and often connecting with a transverse median spot or circle of spots, and these dark markings may connect with the lateral dark mark from the humerus; after the middle there is often a lunate mark which may be separated into two spots near the apex. There is a group of species with short vittate markings along the side, down the middle of the elytra and along the suture. There are many variations in this basic pattern. A few species are entirely pale without any markings. One group of rather large pale species has elytral spots varying from two to twelve in number. Another group of pale species with distinct costae often has numerous small spots, usually placed in the typical pattern. The body beneath is usually pale with the breast often dark. *Neobrotica variabilis* is typical of the genus in its markings.

In the Bowditch collection of *Neobrotica* at the Museum of Comparative Zoology are a number of beetles to which Bowditch has attached manuscript names as new species of *Neobrotica*, evidently planning to describe them at a future date. The majority of these belong in a group closely related to *Neobrotica* but for which I believe a genus should be erected. They possess many characters common to both *Neobrotica* and *Eucerotoma*. They have the transverse sulcus across the prothorax, the appendiculate claws and the open anterior coxal cavities, which are common to both *Neobrotica* and *Eucerotoma* (in *Eucerotoma* the coxal cavities are not so widely open); but unlike *N. variabilis*, have strongly costate elytra, almost as strong as in *Eucerotoma*. Yet unlike *Eucerotoma* they do not have the excavated face and excavated antennal joints in the male; however, the lower front of the head goes a step towards the excavate face of *Eucerotoma* in being bent inwards and is without the carina down the lower front that is found in *Neobrotica*. It is true that in most species of *Neobrotica* there are more or less evident traces of costation, but not to the degree of these beetles, which in turn are not so strongly costate as in *Eucerotoma*. Like *Eucerotoma* they occur mostly in the Andes, but a few are from other parts of South America.

There is yet another group strongly suggestive of the genus *Cerotoma*, of which *N. denticornis* Jacoby is representative. Jacoby gave it its specific name because the third and fourth antennal joints in the male are cut out in a manner similar to that found in *Cerotoma*. These differ from species of *Cerotoma* in having the anterior coxal cavities open and they have a transverse sulcus across the prothorax. *N. denticornis* is only one of a fairly large group possessing these characteristics, that occurs in both Central and South America. Besides having the cut-out antennae, the front of the head is also

excavate in a manner similar to that found in the males of both *Eucerotoma* and *Cerotoma*. They differ from *Eucerotoma* in not having such costate elytra and in the long third antennal joint of the female. When compared with *N. variabilis*, however, they appear widely apart and far from being congeneric, and should be put in a separate genus.

Jacoby had only the female of the species that he named *Neobrotica vittatipennis*. Otherwise he would not have included that very different beetle in *Neobrotica*. It is unlike any that I know and deserves a generic place.

I have taken the opportunity here also to dispose of *Galeruca furcata* Olivier, a species that has been assigned to various genera from *Cerotoma* to *Neobrotica*, and recently placed by Bechyne in a genus he himself described as *Metrobrotica*. By Bechyne's definition of *Metrobrotica* "the third and fourth antennal joints of the male are of a very complicated build", which generic differentiation applies to his genotype *Cerotoma geometrica* Erichson but does not fit *Galeruca furcata* in which the antennae of both sexes are filiform.

Bechyne has transferred another species, *Neobrotica brasiliensis* Bowditch, from *Neobrotica* to *Andrector*. I have examined a female specimen he determined as *N. brasiliensis*, in the Frey Museum, and it is misidentified. As far as I know there is only one specimen of *N. brasiliensis* known—the type in the Museum of Comparative Zoology—and this is a female. There are two other species related to it, all three densely and quite coarsely punctate, all three with a broader prothorax than usual for *Neobrotica*, and all with closed anterior coxal cavities, but otherwise resembling *Neobrotica*. The antennae are like those found in *Neobrotica*, having the third joint no longer than the fourth, and the remaining joints gradually shorter. All three species are from the Amazon region. For these I am erecting the genus *Potamobrotica*.

Growing out of the study of this genus, *Neobrotica*, and its closely related genera, a second paper has been prepared to deal with some of the species that have been in the past relegated to *Neobrotica*, but having excised middle tibiae in the male. In this paper are treated such species as *Neobrotica pallida* Jacoby, *N. achroma* Bechyne, *N. analis* Weise, *N. latifrons* Bechyne and *N. lineigera* Bechyne. It is being published as "More New Galerucine Beetles with Excised Middle Tibiae in the Male" (Proc. U.S. Nat. Mus., 1966, vol. 118, no. 3528, pp. 233–266).

I wish to acknowledge the help I have had financially from the National Science Foundation in enabling me to visit museums in Europe and South America, both to study type specimens and to see and collect more material. The British Museum (Natural History)

(BMNH) and various museums in the United States have loaned me material, notably the Museum of Comparative Zoology (MCZ), the American Museum of Natural History (AMNH), and the California Academy of Sciences (CAS). John A. Wilcox of the New York State Museum has given freely his help in the classification of these difficult galerucine beetles. Gerhard Scherer has made notes and drawings of Bechyne's types in the Frey Museum collection at Tutzing, Germany.

Key to the Genera of Galerucinae Here Treated

1. Head of male unlike that of female, with the front deeply excavated or with a median hole 2
   Head of male similar to that of female 5
2. Head of male with a small median hole over labrum.
   Cyclotrypema, new genus (p. 354)
   Head of male more or less deeply excavate or concave in front 3
3. Third antennal joint of female usually longer than the fourth, rarely equal to it and never shorter . . . . . **Eccoptopsis,** new genus (p. 339)
   Third antennal joint of female equal to or shorter than fourth 4
4. Male antenna with third joint only much widened and irregularly excised in middle, not at end . . . . . **Rachicephala,** new genus (p. 354)
   Male antenna with third and fourth joints widened and excised at adjoining ends . . . . . **Eucerotoma**
5. Anterior coxal cavities closed . . . . . **Potamobrotica,** new genus (p. 351)
   Anterior coxal cavities open 6
6. Front of face with well-developed carina, elytral costae usually faintly developed. **Neobrotica**
   Front of face depressed with carina not much in evidence, elytral costation strong . . . . . **Hystiopsis,** new genus (p. 324)

Key to North and Central American Species of *Neobrotica*

1. Elytra entirely pale or at most with faint humeral darkening 2
   Elytra not entirely pale 5
2. Head dark 3
   Head pale 4
3. Elytra strongly costate . . . . . **pallescens** Jacoby (p. 269)
   Elytra weakly costate . . . . . **modesta** Jacoby (p. 292)
4. Elytra strongly costate . . . . . **semicostata** Jacoby (p. 296)
   Elytra weakly costate . . . . . **inconspicua** Jacoby (p. 297)
5. Head pale with a median occipital spot 6
   Head either pale or dark but without occipital spot 7
6. Elytra with lateral vittate marking and two short median vittae on each elytron . . . . . **spilocephala,** new species (p. 287)
   Elytra without lateral vittate marking and with six spots on each elytron. **oblongo punctata** Jacoby (p. 308)
7. Elytra with a basal and apical, sometimes median, fascia 8
   Elytra with spots, sometimes lunate, or vittate markings 14
8. Basal fascia extending below middle of elytra.
   cartwrightii, new species (p. 281)
   Basal fascia not extending below middle of elytra 9

9. Elytra with two fasciae 10
Elytra with three more or less distinct fasciae 12
10. Elytral fasciae piceous . . . . . **piceofasciata,** new species (p. 280)
Elytral fasciae bluish or violaceous 11
11. Elytra strongly costate . . . . . **zonata,** new species (p. 281)
Elytra weakly costate . . . . . **coeruleofasciata** Jacoby (p. 278)
12. Basal fascia not connected with median fascia . **simulans** Jacoby (p. 290)
Basal fascia more or less connected with median 13
13. Median fascia not connected with apical fascia.
hondurensis Jacoby (p. 290)
Median fascia connected along side and suture with apical fascia.
pterota, new species (p. 291)
14. Elytra with a lateral vitta from humerus to apical curve 15
Elytra with a humeral spot or short vitta not extending to apical curve or dark area in middle of elytra 17
15. Head pale . . . . . **duodecimsignata,** new species (p. 286)
Head dark 16
16. A median vitta, sometimes interrupted . . . . . **oberthüri** (Baly) (p. 284)
No median vitta . . . . . **melanocephala** Jacoby (p. 287)
17. Elytra with a dark basal ring, more or less unbroken, enclosing a pale area 18
Elytra with basal spots or vittate markings 22
18. Elytra very strongly and coarsely punctate . **punctatissima** Jacoby (p. 288)
Elytra not so coarsely punctate 19
19. Elytra dark with a basal round pale area and an apical rounded pale area open at apex . . . . . **quadriplagiata** Jacoby (p. 289)
Elytra pale with a more or less complete dark apical as well as basal ring 20
20. Basal ring and usually apical ring complete . . . . **ornata** Jacoby (p. 277)
Basal and apical ring not usually complete 21
21. Legs pale . . . . . **noumenia,** new species (p. 276)
Legs with tibiae and tarsi dark . . . . . **variabilis** Jacoby (p. 273)
22. Elytra with basal vittae 23
Elytra with basal spots 27
23. Elytra with 3 short basal vittae joined across base, one down the side, one at middle and another at suture . . . . . **dentata,** new species (p. 277)
Elytra with a short basal and sutural or subsutural vitta 24
24. Elytra with a short lateral and short subsutural basal vitta.
linigera Jacoby (p. 285)
Elytra with a short lateral and a short sutural basal vitta 25
25. Elytra with a spot at apical curve . . . . . **trichops,** new species (p. 283)
Elytra with a short vitta at apical curve 26
26. Large, a large median apical spot and a short lateral apical vitta.
imitans Jacoby (p. 274)
Small, a small median apical spot and a long lateral apical vitta.
coeruleolineata Jacoby (p. 282)
27. Head dark 28
Head pale 29
28. Large, 7 mm. each elytron with three small spots (not counting the dark scutellum) . . . . . **septemmaculata,** new species (p. 298)
Small, 5 mm. each elytron with 5 small spots (not counting the dark scutellum) . . . . . **undecimmaculata** Jacoby (p. 275)

29. Each elytron with 4 spots (not counting dark scutellum).
pentaspilota, new species (p. 299)
Each elytron with more than 4 spots 30
30. Each elytron with 5 spots (not including dark scutellum) 31
Each elytron with 6 spots or more 33
31. A large spot in middle near base and a small spot below humeral spot.
decimsignata, new species (p. 297)
No large median spot near base or small spot below humeral spot . . . 32
32. Large, claws with a long inner tooth . . **quinquepunctata** (Jacoby) (p. 300)
Smaller, claws without inner tooth . . . . . **schausi,** new species (p. 275)
33. Each elytron with 6 spots 34
Each elytron with 7 spots 35
34. Strongly costate . . . . . **sexmaculata** Jacoby (p. 293)
Feebly costate . . . . . **tampicensis,** new species (p. 295)
35. Elytral punctures contiguous. . . . **matamorasensis,** new species (p. 294)
Elytral punctures not contiguous . . . . . **pluristicta** Fall (p. 294)

Neobrotica variabilis Jacoby

FIGURES 1, 2

Neobrotica variabilis Jacoby, *in* Godman and Salvin, Biologia Centrali-Americana, Coleoptera, vol. 6, pt. 1, p. 572, 1887; Proc. Zool. Soc. London, p. 286, 1889. [Not *variabilis*.]

About 7 mm. in length, elongate oblong oval, somewhat shining, the elytra indistinctly alutaceous and semistriately punctate between the faint costae; pale yellow brown with the head piceous, the lower front of head brownish, antennae with the intermediate joints faintly brownish, elytra with piceous markings about the scutellum, on humeri, and along side, curving about towards the suture, and a narrow, somewhat curved apical band.

Head with the interocular space approximately half width of head, occiput piceous, the front reddish brown. Antennae pale with joints five to eight brownish and the tip of the terminal joint dark. Prothorax with rounded sides and well defined transverse sulcus, finely and not densely punctate, pale yellowish brown. Scutellum brownish. Elytra wider in apical half, indistinctly alutaceous, the punctation tending to be striate between the feebly marked costae. In the type, a piceous marking from humerus down along side about one-third the length of the elytra, then curving across to the suture and nearly meeting a scutellar dark marking that extends shortly down the suture; in the apical half a somewhat curved piceous marking. In the variety, the markings in basal half of the elytra are broken up into a humeral dark spot, a dark area about the scutellum, and two spots across the elytron before the middle, and in the apical half a rather broad semilunate dark marking. Body beneath with the breast dark, rest of the undersurface pale, legs pale, with outside of tibiae brownish in the type, and in the variety the tibiae and tarsi dark. Length of type 7 mm., width 3.5 mm.

Type, female, BMNH; type of variety, female, Bowditch collection, MCZ; both collected by Höge in Jalapa, Mexico.

Remarks: The two specimens from Jalapa, Mexico, one of which Jacoby named a variety, are probably the same species. But Jacoby in 1889 described briefly two specimens collected at Corozal, Venezuela, that he stated agreed in every way with the Mexican specimens except in the color of the legs and antennae, which were entirely pale in the Venezuelan specimens. The writer has examined one of these Venezuelan specimens that is in the Bowditch collection (MCZ) and believes it different and is describing it as a new species. Weise has selected *Neobrotica variabilis* as the type of the genus.

Neobrotica imitans Jacoby

FIGURE 9

Neobrotica imitans Jacoby, *in* Godman and Salvin, Biologia Centrali-Americana, Coleoptera, vol. 6, pt. 1, p. 573, 1887.

Between 5.5 and 7 mm. in length, elongate oblong oval, shining, faintly alutaceous; body pale yellow brown, the antennae and legs entirely pale, the head, breast and spots on the elytra piceous.

Head with the interocular space less than half width of the head, shining piceous, the occiput with faint punctures and a median depressed spot above the frontal tubercles, a short carina down lower front. Antennae entirely pale. Prothorax not twice as wide as long, with rounded sides and a transverse sulcus, very finely punctate, faintly alutaceous, pale yellow brown. Scutellum deep brown. Elytra widened in apical half, rather densely, coarsely and shallowly punctate, the punctures tending to be striate, very faint traces of costae; pale yellow brown with a long inwardly curving black vitta from humerus about one-fourth the way down elytra; another vitta from about scutellum down the suture a short way, a triangular spot near these in the middle and before the apex a median and a lateral spot. Body beneath and legs pale with the breast dark. Length 5.5–7 mm.; width 2.7–3.5 mm.

Type, male; one female paratype; both BMNH; one female paratype, MCZ; all from Costa Rica, collected by Van Patten.

Other localities: Coronado, Costa Rica, 1400 m., 1932, collected by Nevermann.

Remarks: The three specimens of the series collected in Costa Rica by Van Patten are all very much alike. A specimen from the Baly collection without a legible locality is in the British Museum. As Jacoby writes, this species strongly resembles *Diabrotica novemmaculata* Jacoby in its elytral pattern.

Neobrotica undecimmaculata Jacoby

FIGURE 6

Neobrotica undecimmaculata Jacoby, *in* Godman and Salvin, Biologia Centrali-Americana, Coleoptera, vol. 6, pt. 1, p. 575, 1887.

Between 5 and 6 mm. in length, elongate oblong oval, faintly shining, alutaceous, the elytra finely and not densely punctate, head on top, tibiae, tarsi, and breast piceous, elytra with reddish brown to piceous spots on the humeri, two transversely across elytron before the middle and two after the middle.

Head with the interocular space about half the width of the head, occiput shiny piceous, very minutely punctate, a median depression above the well-marked frontal tubercles, carina down front, lower front to labrum which is dark, pale reddish brown. Antennae with the three basal and three apical joints pale, the rest dark brown. Prothorax not twice as broad as long with a transverse sulcus most marked at the sides; sides nearly straight, surface finely punctate, pale. Scutellum either reddish brown or piceous. Elytra finely alutaceous and unusually finely punctate, with two or three feeble lateral costae, pale with reddish brown to piceous markings, the spots small and located as above; on the British Museum specimen a dark area about the scutellum and extending a little way down the suture, the specimen in the Bowditch collection without this. Body beneath pale with the breast dark; tibiae and tarsi dark, femora pale. Length 5.7 mm.; width 2.9 mm.

Type, male, MCZ; one female paratype, BMNH; both from Jalapa, Mexico, collected by Höge.

Other locality: Xilitla, Mexico, Dreisbach, July 23, 1954, Monrós collection, USNM.

Remarks: The dark head and unusually fine punctation of the elytra distinguish this species from many others with similar markings.

Neobrotica schausi, new species

FIGURE 5

About 6.5 mm. in length, elongate oblong oval, faintly shining and faintly alutaceous, the elytra with costae most marked in the middle of the elytra, finely punctate; pale yellow brown, somewhat deeper in color over the occiput but not at all piceous, the elytra with small reddish-brown humeral spot, two small spots before and two after the middle of each elytron, body beneath entirely pale.

Head with interocular space less than half width of head, a small median depression over the well-marked frontal tubercles and a short carina down the short lower front, occiput of head a shade deeper in color than the lower front but not at all piceous. Antennae with the

terminal joints missing, the basal joints a little paler than the reddish brown outer joints, third and fourth joints subequal. Prothorax with a transverse sulcus, surface alutaceous, finely punctate. Scutellum deeper reddish brown. Elytra with distinct costae, more marked from the middle to the side, punctation fine and confused; surface alutaceous; elytra pale yellow brown, each with five small reddish-brown spots, one on the humerus, one below on the side before the middle and the second lateral one near the apical curve, opposite this and near the suture two other spots. Body beneath entirely pale, the tibiae and tarsi a deeper reddish brown, front tibiae and first tarsal joint of male enlarged. Length 6.5 mm.; width 3.2 mm.

Type, male, AMNH, from Jalapa, Mexico, collected by W. Schaus.

Remarks: Possibly some specimens have a piceous head and piceous elytral spots, but the single male known appears to be a mature specimen and differs from *N. undecimmaculata* Jacoby in having a pale head and breast and a narrower interocular space. Both are from Jalapa, Mexico.

***Neobrotica noumenia*, new species**

FIGURE 3

Between 6.5 and 7.5 mm. in length, elongate oblong oval, moderately shiny although feebly alutaceous, the elytra strongly and densely punctate, and feebly costate; pale yellow with dark upper half of head and dark mouthparts, entirely pale legs and antennae and brown breast, elytra with a dark humeral spot and narrow transverse fascia below, a narrow dark sutural line a little below scutellum, and a slender semilunate dark mark near apex, these dark markings sometimes with a purplish lustre.

Head with interocular space less than half width of head, shiny piceous over occiput, pale in lower front with the mouthparts dark, very finely punctate, the frontal tubercles distinct and a median depression above them, a narrow carina down lower front. Antennae entirely pale yellow. Prothorax only a little wider than long with slightly rounded sides and a transverse sulcus, very finely alutaceous, entirely pale yellow. Scutellum tan colored. Elytra with costate wrinkling, densely and distinctly punctate and with a tendency to being geminate striate punctate, faintly alutaceous; a piceous or deep purplish marking on humerus, a transverse fascia not quite across the elytron, interrupted at the suture, and a short narrow sutural vitta, also a narrow semilunate mark near apex. Body beneath entirely pale except brownish breast, legs pale, a spine on middle and hind tibiae. Length 6.7–7.5 mm.; width 3.3–3.7 mm.

Type, female, MCZ 30665; one female paratype, USNM; both from Cuernavaca, Mexico. One specimen from Cuernavaca, Aug. 30, 1944, on *Eupatorium adenophorum*, collected by N.L.H. Krauss.

Other localities: Escuintia, Guatemala, F. Knab, collector.

Remarks: On one of the specimens is an old label, *Diabrotica biannularis* Harold, a species that it strongly resembles in its elytral markings. There are three specimens, all females, in the MCZ with no locality label. They all have delicate narrow dark markings. The faint purple lustre of some is suggestive of *N. coeruleolineata* Jacoby, but I have not seen specimens of *N. noumenia* with a long stripe from the shoulder.

***Neobrotica dentata*, new species**

FIGURE 7

About 7 mm. in length, elongate oblong oval, shining, the elytra faintly alutaceous and distinctly and somewhat striately punctate, with faint lateral costae; pale yellow brown, the head entirely piceous and the elytra with wide dark humeral, median and sutural vittae united at the base and not extending to the middle of the elytra, a wide dark lunate mark at apex, sometimes divided into two spots, the legs, antennae and undersurface except the dark breast, pale.

Head with interocular space less than half the width of head, occiput finely punctate, a depression above the frontal tubercles and a narrow carina down front; entirely piceous. Antennae entirely pale yellow brown. Prothorax about a third wider than long with rounded sides, finely punctate, a transverse sulcus and shining pale yellow brown. Scutellum dark brown. Elytra shining although faintly alutaceous, distinctly and somewhat geminately striate punctate, some traces of lateral costae, pale yellow with a dark marking having a faint bluish lustre, a broad darkening in basal fourth of elytra with very narrow pale inlets in middle and at suture in lower part, and a wide semicircular mark opening at the apical end and at apex. Body beneath and legs entirely pale except for the black breast. Length 6.5–7.2 mm.; width 2.7–3.5 mm.

Type, female, USNM 66845, from San José, Costa Rica, collected by J. F. Tristan. Specimens also from San José, 1000–1200 m., collected by F. Nevermann, and by M. Valerio, Sept. 17, 1930, on *Chamaedorea*.

Remarks: The unusual elytral markings of this species differentiate it from the others. It was collected at San José, Costa Rica, by three different collectors. The specimen collected by M. Valerio is in the MCZ.

***Neobrotica ornata* Jacoby**

FIGURES 23, 24

Neobrotica ornata Jacoby, *in* Godman and Salvin, Biologia Centrali-Americana, Coleoptera, vol. 6, pt. 1, p. 572, 1887.

From 5 to 7 mm. in length, elongate oblong oval, feebly shining,

alutaceous, the elytra with three or four faintly marked short costae, head dark with the front paler, antennae with the intermediate joints darker; legs, pronotum and body beneath, except the breast, pale; elytra with a dark basal ring and a dark apical one, the middle of the ring being pale, apical ring sometimes not complete.

Head with interocular space a little less than half width of head, frontal tubercles well marked, a median depression above, occiput finely punctate, a narrow carina running down the front, the top of the head piceous, lower front deep reddish brown, sometimes even pale yellow, with the mouthparts dark. Antennae pale at base and apex, joints five to eight usually deeper brown. Prothorax somewhat wider than long with slightly curved sides and a transverse depression, alutaceous and very finely punctate, entirely pale yellow. Scutellum pale or reddish brown. Elytra with feeble costae, alutaceous and rather coarsely punctate, entirely pale yellow with a large basal and apical ring that is sometimes slightly purplish, the apical ring occasionally not complete on the apical side towards suture. Body beneath pale with the breast dark, legs pale, hind tibiae with spine, anterior coxal cavities open, claws appendiculate. Length 5–7 mm.; width 2.5–3.5 mm.

Type, BMNH; three paratypes, MCZ; all from Tapachula in Chiapas, Mexico.

Other localities: Tuxtla, Teapa, Tabasco, Mexico, collected by Sallé, H. H. Smith, and Höge; Cordova, Vera Cruz, Mexico, collected by Höge, A. Fenyes, and F. Knab; Rio Antonio, Oaxaca, Mexico, F. Knab, collector. Escuintla, Guatemala, and Izalco, Salvador, both collections by F. Knab. Turrialba, Costa Rica, O. L. Cartwright, collector, June 1951. Barro Colorado Island, Canal Zone, S. W. Frost, collector; El Valle, Canal Zone, N. L. H. Krauss, collector; Porto Bello, Canal Zone, Busck, Jennings, collectors.

Remarks: Jacoby wrote that this species resembles *Diabrotica biannularis* Harold in its elytral markings. In one specimen from Teapa, Mexico, he wrote that the rings were connected along the side by a dark line. I have examined one specimen marked like this which bears solely the locality label "Mexico" and is a female, now in the Bowditch collection at the Museum of Comparative Zoology.

Neobrotica coeruleofasciata Jacoby

FIGURES 19, 20

Neobrotica coeruleofasciata Jacoby, *in* Godman and Salvin, Biologia Centrali-Americana, Coleoptera, vol. 6, pt. 1, p. 575, 1887.

About 5.5 mm. in length, elongate oblong oval, shining, the elytral punctation strong and semistriate, faint traces of costae along the sides, pale yellow, the head entirely dark, the breast piceous, antennal joints

five to eight deeper in coloring; elytra with a wide blue fascia at the base and another large roundish area near the apex which is excavate at the apical end.

Head with the interocular space less than half width of head, occiput shining, impunctate, carina narrow, not much elevated, with punctures on the lower front, and a depression above the frontal tubercles. Antennae pale yellow with joints five to eight deeper brown. Prothorax with the sides only slightly rounded, a sulcus across, alutaceous and finely punctate, pale yellow. Scutellum dark. Elytra with a wide dark blue basal fascia and a large rounded spot below the middle on each elytron joined at the suture; punctation dense and semistriate, with faint costae. Body beneath pale except for the dark piceous breast, legs entirely pale. Length 5.7 mm.; width 2.8 mm.

Type, male, BMNH; one paratype; both from Caldera, Panama, collected by Champion; two others from the Volcan de Chiriqui, also collected by Champion.

Remarks: In the British Museum are four specimens, two from Caldera, two from the Volcan de Chiriqui, that are of the same species. Jacoby listed under *N. coeruleofasciata* other specimens from Bugaba and Tolé that are not the same. He appeared doubtful about these as he noted that the space between the eyes was different. These are described under *N. confusa* and *N. piceofasciata*.

There are several specimens from Costa Rica that may be of this species also, although the markings are somewhat different in two of the three. In the Bowditch collection is a specimen from San Carlos, Costa Rica, collected by Schild and Burgdorf and also one in the U.S. National Museum of the same label, and another from Bataan, Costa Rica, collected by M. Stelzer; one of the San Carlos specimens and the Bataan specimen have only the outer half of the elytron covered with a dark violaceous spot. Otherwise these appear to be like Jacoby's *coeruleofasciata*.

Neobrotica confusa, new species

FIGURE 21

Neobrotica coeruleofasciata Jacoby (in part), *in* Godman and Salvin, Biologia Centrali-Americana, Coleoptera, vol. 6, pt. 1, p. 575, 1887.

About 7 mm. in length, elongate oblong oval, moderately shiny although alutaceous, elytra with numerous feeble costae, distinctly and irregularly striate punctate, head and breast dark, antennae, pronotum, legs and rest of undersurface yellow; the elytra yellow with a broad dark basal fascia having metallic blue or green lustre and sometimes enclosing a small pale spot; another broad fascia near the apex that is sometimes lunate; sometimes these fasciae represented only by a lunate basal and apical marking.

Head with the interocular space nearly half the width of head, frontal tubercles distinctly marked and with a median depression above them, a distinct carina down the lower front, the occiput finely punctate, entirely shining piceous. Antennae pale. Prothorax somewhat wider than long with a transverse sulcus, very finely punctate and finely alutaceous, entirely pale. Scutellum dark. Elytra strongly, densely and semistriately punctate and feebly costate, a broad dark basal fascia with a metallic green lustre extending one-third the length of the elytra and enclosing a small round pale spot in the middle, and at the apex another roundish dark fascia with the apex hollowed out as if the opening of an apical ring. Body beneath pale, except the breast, legs pale. Length 6–8 mm.; width 3.1–3.8 mm.

Type, ?female, MCZ 30668, from Bugaba, Panama, collected by Champion.

Other localities: Porto Bello, Canal Zone, A. Busck, E. A. Schwarz, collectors; Ancon, Canal Zone, A. H. Jennings, collector; El Valle, Canal Zone, N.L.H. Krauss, collector; Cabima, Canal Zone, A. Busck, collector; Muso, Colombia.

Remarks: Jacoby noted that there was a difference in the interocular space between some of the specimens that he had assigned to the species *N. coeruleofasciata*, the two from Bugaba having a wider interocular space as well as somewhat different elytral markings. There are other specimens in the U.S. National Museum from the Canal Zone and one from Colombia that resemble the Bugaba specimens. They are in general a little larger than *N. coeruleofasciata*.

***Neobrotica piceafasciata*, new species**

FIGURE 27

Neobrotica coeruleofasciata Jacoby (in part), *in* Godman and Salvin, Biologia Centrali-Americana, Coleoptera, vol. 6, pt. 1, p. 575, 1887.

About 7 mm. in length, elongate oblong oval, shining, the elytra rather coarsely punctate, head dark, thorax pale, elytra pale with a wide piceous basal band and another below the middle; antennae, legs and undersurface except the dark breast, pale.

Head with the interocular space less than half the width of head, occiput polished, finely punctate, tubercles distinctly outlined, a small depression above them; the carina distinct, with punctures on either side, head entirely piceous. Antennae pale yellow brown, the terminal joint tipped with piceous. Prothorax with the sides nearly straight, not deeply sulcate across, shining, finely punctate, pale yellow. Scutellum dark. Elytra with distinct short intrahumeral sulcus; punctures strong, tending to be geminate, pale yellow with a broad basal piceous fascia and another below the middle, the apex pale.

Body beneath pale with the breast dark, legs entirely pale. Length 7 mm.; width 3.5 mm.

Type, female, BMNH, from Tolé, Panama, collected by Champion.

Remarks: This is one of the specimens under *N. coeruleofasciata* Jacoby in the British Museum collection. *N. piceofasciata* is, however, a distinct species, differing from *coeruleofasciata* in several points: the space between the eyes is less, the antennae are shorter and entirely pale, except for the tip, in contrast to the bicolored ones of *coeruleofasciata*. In addition, the elytral markings are piceous, without metallic lustre, and the beetle is larger and without costae. The apical spot on the elytra is not at all emarginate at the lower end.

Neobrotica sonata, new species

FIGURE 22

About 7 mm. in length, elongate oblong oval, shining, the elytra distinctly but not deeply costate, the interspaces with geminate striate punctation; pale yellow with a piceous head, and the elytra with a wide deep blue basal fascia having in the middle of each elytron a small pale spot, and a curved dark blue fascia before the apex, the antennae, legs and undersurface except the piceous breast, pale.

Head with interocular space about half width of head, occiput smooth, shining, a median depression over the frontal tubercles and a fovea on either side, a narrow carina down lower front, head shining black. Antennae with only eight joints, the rest missing, pale yellow brown. Prothorax not quite twice as broad as long with rounded sides, a distinct transverse sulcus, surface with a few fine punctures, faintly alutaceous, pale yellow, shining. Scutellum pale. Elytra wider in apical half, strongly but not deeply costate, the costae not much raised but smooth and broad, the interstices with rather coarse geminate striate punctures, surface finely alutaceous but shining; markings of deep violet blue, a basal fascia with a pale spot in the middle and an apical one, somewhat curved, near the apical end, apex pale. Body beneath and the neck of the head pale, but the breast shining piceous, legs entirely pale. Length 7 mm.; width 3 mm.

Type, female, BMNH, from Guatemala.

Remarks: Jacoby has attached a label to this "*?ornata*". It is with markings and coloration somewhat similar to *N. ornata*, but the elytra are more costate.

Neobrotica cartwrighti, new species

FIGURE 25

About 7.5 mm. in length, elongate oblong oval, shining, the elytra distinctly but not strongly costate with the intervals densely geminate

striate punctate; yellow with a black head and breast, brown tibiae and tarsi, the elytra with a wide dark blue fascia in the basal half and another narrower one in the apical half, the intervening pale fascia narrow, the apex and margin pale.

Head with the interocular space approximately half width of head, a median depression above, frontal tubercles distinct, and a narrow carina down the lower front, occiput smoothly rounded, shining, very finely punctate, entire head black. Antennae with the basal and apical four joints pale. Prothorax wider than long with slightly rounded sides and a transverse sulcus, polished, a few very fine punctures, yellowish brown. Scutellum tan colored. Elytra shining, although faintly alutaceous, with strong geminate striate punctation between the rather feeble costae; a broad steel blue fascia covering basal half of elytra, then a narrow pale yellow fascia and in the apical half another narrower dark blue fascia, the apex and margin pale. Body beneath very lightly pubescent, pale yellow with the breast dark, the femora pale, the tibiae and tarsi dark brown. Length 7.4 mm.; width 3.6 mm.

Type, female, USNM 66847; one female paratype; both from Turrialba, Costa Rica, May 28 and June 5, 1951, respectively, collected by O. L. Cartwright.

Remarks: The large size and the dark blue fasciae on the elytra readily distinguish this species. I take pleasure in naming it after its collector.

Neobrotica coeruleolineata Jacoby

FIGURE 8

Neobrotica coeruleolineata Jacoby, *in* Godman and Salvin, Biologia Centrali-Americana, Coleoptera, vol. 6, pt, 1, p. 753, 1887.

Between 5 and 7 mm. in length, elongate oblong oval, feebly shining, alutaceous, the elytra strongly, densely and semistriately punctate between the feeble elytral costae, head tending to be dark on occiput, sometimes entirely dark, intermediate joints of the antennae dark, prothorax, legs, body beneath pale, except breast, elytra with a long dark, slightly metallic blue or green vittate marking from the humerus a little way down the side, another from scutellum down the suture a way, a spot before and after the middle, and another lateral vitta at apical curve not joined with the humeral vitta; front tibiae in the male enlarged.

Head with the interocular space less than half width of head, frontal tubercles somewhat swollen, a median depression above them, a narrow carina running down the lower front, occiput smooth with a few very fine punctures, usually the upper half of head deeper in color from tan to piceous, lower front paler, labrum dark, sometimes entire

head pale or entirely dark. Antennae with the three or four basal and three apical joints pale. Prothorax somewhat wider than long with slightly curved sides and a transverse sulcus, surface shining, very finely punctate, entirely pale. Scutellum pale. Elytra dull alutaceous with distinct dense punctation, tending to be geminate striate between the feeble elytral costae, pale yellow with dark metallic markings about the scutellum down the suture at base, down the side from the humerus and along the apical curve, and two spots, one before and the other after the middle in the middle of each elytron. Body beneath pale with the breast darker, legs sometimes entirely pale, sometimes with a dark streak on the outside of the tibiae, front tibiae much enlarged in the male, and first tarsal joint large. Length 5.2–6.8 mm.; width 2.5–3.2 mm.

Type, male, MCZ; six paratypes, MCZ; 5 paratypes, BMNH; all from Teapa, Tabasco, Mexico, collected in March by H. H. Smith.

Other localities: Tepansacualco, Mexico, Sallé, collector, Tapachula, Mexico, Höge, collector; San Isidro, Guatemala, Champion, collector.

Remarks: The specimen from San Isidro, Guatemala, is a female with distinct costae, very dull alutaceous surface, entirely pale legs and only faintly darker intermediate joints of the antennae. The distinguishing marks of this species are the blue or greenish lateral vittate markings interrupted in the middle along the side of the elytra, and, in the male, the swollen front tibiae.

Neobrotica trichops, new species

FIGURE 4

Between 6 and 7 mm. in length, elongate oblong oval, feebly shining, elytra distinctly and densely punctate, with traces of costae, pale yellow, head with dark mouthparts and often dark about the eyes, elytra with a long dark humeral vitta with a greenish or violet lustre, and a narrow dark vitta at the base along the suture, a small median spot before and two small spots below the middle; tibiae with a dark streak, breast dark, intermediate joints of the antennae dark.

Head with the interocular space less than half the width of the head, eyes very large, frontal tubercles distinct with a median depression above, occiput smooth, a few hairs about edge of eyes, a narrow carina down front, a dark area usually about eyes and dark mouthparts. Antennae with the basal and apical joints paler than the intermediate ones. Prothorax somewhat wider than long with slightly curved sides and a tranverse sulcus across, alutaceous, with a few fine punctures, pale. Scutellum pale. Elytra feebly shining, alutaceous, distinctly and densely punctate, tending to be geminate striate between the feeble traces of costae; pale yellow with long dark vitta, often having a violet or green lustre, from humerus down the

side of the elytra, in one specimen almost connecting with a spot at apical curve, a shorter narrow suturual vitta below the scutellum, and a small median spot before and one after the middle on each elytron. Body beneath pale with the breast dark, legs pale, the tibiae usually with a dark streak. Length 6.8–7.2 mm.; width 3–3.6 mm.

Type, male, USNM 66842; three paratypes (one in MCZ), all from Tucurrique, Costa Rica, collected by Schild and Bergdorf.

Other localities: Turrialba, Costa Rica, May 21, 22, 1951, and June 19, 1951, O. L. Cartwright, collector.

Remarks: E. A. Schwarz has labeled specimens in the U.S. National Museum as *N. coeruleolineata* Jacoby, but *N. trichops* differs from that species in having no apical side vitta, and having dark tibiae as well as a differently shaped aedeagus. The elytra are longer and the head is usually paler than in *N. coeruleolineata*.

Neobrotica oberthüri (Baly)

FIGURES 16, 17, 18

Diabrotica oberthüri Baly, Trans. Ent. Soc. London, p. 452, 1886.

Neobrotica oberthüri (Baly).—Jacoby, *in* Godman and Salvin, Biologia Centrali-Americana, Coleoptera, vol. 6, pt. 1, p. 575, 1887; Proc. Zool. Soc. London, p. 286, 1889.

About 7 mm. in length, elongate oblong oval, shiny, the sulcus across the pronotum not very well defined in the middle, the elytra moderately, densely and strongly punctate, not at all costate, pale yellow with a black head and breast, dark tibiae and tarsi and intermediate joints of the antennae, and dark vittae or remnants of vittae on the elytra.

Head with the interocular space about half width of head, a depression above the frontal tubercles, occiput shining piceous and finely punctate, the tubercles, carina and much of the lower face brownish, the neck below yellow. Antennae pale with joints four to eight dark. Prothorax with slightly rounded sides, the transverse sulcus more distinct on the sides; surface shining, punctate, pale yellow. Scutellum piceous. Elytra without a trace of costae, densely and confusedly punctate with a tendency to being striate in some specimens; pale yellow usually with a lateral vitta from the humerus nearly to the apex, this may be broken so only a short humeral and apical vitta remain, the same being true of the median vitta, and the sutural often consisting only of a short basal and apical darkening. Body beneath pale with the breast dark, the femora pale, tibiae and tarsi dark. Length 6.8 mm.; width 3.3 mm.

Type, female, BMNH, Baly collection, without locality label (although in his description, Baly gives the locality simply as Guatemala).

Remarks: In the BMNH there are four specimens from Guatemala besides the type, and these have variable elytral markings in which the vittae are more or less interrupted. One of the specimens with unbroken vittae bears the label Capetillo, Guatemala, collected by Champion, and in the Bowditch collection is another from Capetillo in which the median vitta is broken. In a later publication Jacoby adds the locality Corozal, Colombia, for the species, but I have been unable to find the specimen either in the British Museum or the Bowditch collection. In the latter there are two specimens from South America under this species, one labelled Venezuela, the other Caracas, and in the U.S. National Museum is a specimen from Turmero, Venezuela, collected in November 1931 by Martorell. The only male specimen is the one from Caracas, and whether these South American specimens are the same as the ones from Guatemala is at present impossible to say.

As Jacoby notes, the markings of this species bear a strong resemblance to those of *Diabrotica nigrolineata* Jacoby.

Neobrotica linigera Jacoby

FIGURE 10

Neobrotica linigera Jacoby, *in* Godman and Salvin, Biologia Centrali-Americana, Coleoptera, vol. 6, pt. 1, p. 574, 1887.

About 6.5 mm. in length, elongate oblong oval, shining, the elytra with traces of costae and the intervals strongly and semistriately punctate, pale yellow with a piceous head and the marks on the elytra having a bluish lustre, a subsutural vitta extending one-third the way down, another from the humerus of equal length and two short vittate marks below the middle, one on the side at the apical curve, and the other near the suture, and in some specimens the pale yellow of the elytra across the middle becoming a deeper yellow band, legs and body beneath pale yellow except the dark breast.

Head with interocular space approximately half width of head, frontal tubercles distinctly marked and a deep median depression over them, the occiput finely punctate, a narrow carina running down lower front, shining piceous with the mouthparts usually paler. Antennae pale yellowish brown. Prothorax a little wider than long, with curved sides and a transverse sulcus, finely punctate, shining, pale yellow. Scutellum pale. Elytra shining, with traces of costae especially marked near base, having the intervals geminate striate punctate; pale yellow with dark markings having a bluish lustre and consisting of a long vittate mark from the humerus down the side curving slightly inwards, in one specimen in the British Museum this inward curving fascia almost joined with a subsutural vitta of the same length; below the middle a vittate mark at apical curve and another often with a

spot beside it, near the suture; in some of the specimens the pale yellow becomes deeper yellow in a band across the middle. Body beneath and legs pale with the breast dark. Length 5.9–7 mm.; width 2.9–3.2 mm.

Type, male, MCZ; seven paratypes, three in MCZ four in BMNH, all from Volcan de Chiriqui, Panama, collected by Champion.

Other locality: Bugaba, Panama, collected by Champion.

Remarks: The markings of this species are very similar to many others except that the basal vitta from the scutellum is not quite sutural, but subsutural.

Neobrotica duodecimsignata, new species

FIGURE 11

Between 4 and 5 mm. in length, oblong oval, shining, faintly alutaceous, the elytra with fine punctation, feebly costate, yellow brown with a brownish margin about the eyes, brown intermediate joints of the antennae, often a brownish outer streak on tibiae and tarsi, the elytra with dark brown vittate markings extending part way down the suture, along the side, sometimes interrupted, and a median interrupted vitta, a short vittate marking at the base and two elongate spots in the middle sometimes joined into a vitta.

Head with the interocular space less than half width of the head, occiput shining and smooth, a depression above the frontal tubercles, carina smooth and narrow, a deepening in color about the eyes, otherwise pale. Antennae pale with the intermediate joints deeper brown. Prothorax about one-third wider than long with slightly curved sides and a transverse sulcus, shining yellow brown, finely punctate. Scutellum pale. Elytra alutaceous and distinctly punctate, a well-marked costa laterally and smaller ones near the middle, pale yellow brown with a deep brown vitta from the humerus along the side which may be broken into two elongate spots along the side, another in the middle consisting of a short vittate mark at the base, a longer one often connected with another below the middle, also a dark brown mark about the scutellum extending down the suture more or less to the middle. Body beneath pale, the legs either entirely pale or with a brownish streak on the outside of the tibiae. Length 4.4–5.2 mm.; width 2.2–2.5 mm.

Type, male, BMNH (bearing handwritten name "*12-signata*," probably by Baly), from Teapa, Mexico, Baly and Fry collection labels; one paratype, male, Bowditch collection, MCZ, with Baly collection and Jacoby 2nd collection labels.

Remarks: Only two specimens of this small species are known, one with the label Teapa, the other without locality label. The vittate markings are the distinguishing characteristics of this species.

The pale head is different from that found in *N. oberthüri* Baly and *N. atrilineata*.

***Neobrotica spilocephala*, new species**

FIGURE 12

About 7 mm. in length, elongate oblong oval, alutaceous, not very shiny, the elytra faintly costate, pale yellowish brown, the head with a median occipital piceous spot and also a piceous area about the eyes, the elytra with a violaceous or greenish mark running across the base and down the side to the apical curve and another vitta a little way down the suture, two median spots, one before and the other after the middle on each elytron, antennae with the intermediate joints dark, breast dark.

Head with the interocular space half width of head, occiput finely punctate, a depression over the frontal tubercles, carina well developed, pale with a piceous spot at base of the occiput and a dark area about the back of the eyes, mouthparts more or less piceous. Antennae with pale basal and terminal joints, intermediate ones dark brown. Prothorax with slightly curved sides and a transverse sulcus, pale yellowish brown, finely punctate. Scutellum pale. Elytra faintly costate along the sides, finely and rather sparsely punctate, alutaceous, not very shiny, pale yellowish brown with violaceous or greenish markings along the base and side down to the apical curve and also about the scutellum down the suture, a median spot before and another one after the middle, and the lateral darkening opposite each wider, as if possibly in darker specimens to connect with the median spot. Body beneath pale with the breast dark; legs pale with the tibiae and tarsi a little deeper in coloring on the outside. Length 7 mm.; width 3.3 mm.

Type, female; one paratype, female; both in BMNH, Baly collection; from Teapa, Mexico.

Remarks: The occipital dark spot is unusual in the genus and besides this species is found only in *Neobrotica oblongopunctata* Jacoby and *N. ebraea* (Fabricius). This species has somewhat the same elytral pattern as *N. duodecimsignata* but in that species there is no metallic lustre and the legs are pale.

***Neobrotica melanocephala* Jacoby**

FIGURE 28

Neobrotica melanocephala Jacoby, *in* Godman and Salvin, Biologia Centrali-Americana, Coleoptera, vol. 6, pt. 1, p. 579, 1887.

About 7 mm. in length, elongate oblong oval, the elytra costate with geminate striate punctures in the intervals, head, breast, tibiae and tarsi dark, the elytra pale with a narrow piceous edging along the

base, the sides and half way down the suture, a small dark spot near the apex common to both elytra and a still smaller spot on each elytron near it.

Head with the interocular space more than half width of head, the occiput with fine punctures, a depression over the frontal tubercles, and a short and somewhat depressed carina down the lower front with punctures on either side. Antennae with the three basal and three terminal joints pale, the rest dark. Prothorax not twice as broad as long with the sides slightly rounded, a well defined transverse sulcus across disc; surface shining, very finely and sparsely punctate, pale. Scutellum pale. Elytra widened behind, shining, not alutaceous, distinctly costate, the costae not much elevated but broad and smooth and impunctate, between them rather fine geminate striate punctures, coarser on the sides; pale reddish brown with dark piceous markings along the side, base, and narrowly down the suture to the middle; a small spot common to both elytra before the apex and near it a still smaller spot on each elytron. Body beneath with the breast dark, the femora pale, tibiae and tarsi dark brown. Length 6.8 mm.; width 3.5 mm.

Type, female, BMNH, from Cordova, Mexico, collected by Sallé; only a single specimen known.

Remarks: The costate elytra and dark markings along the side differentiate this from other Central American species. The color pattern is similar to several South American species, which have more deeply costate elytra that are here treated in the genus *Hystiopsis*, a genus that appears to be confined to South America.

Neobrotica punctatissima Jacoby

FIGURE 30

Neobrotica punctatissima Jacoby, *in* Godman and Salvin, Biologia Centrali-Americana, Coleoptera, vol. 6, pt. 1, p. 573, 1887.

About 6 mm. in length, broadly oblong oval, somewhat shiny, the elytra very coarsely and irregularly geminate striate punctate, pale yellow brown, the head deep reddish brown to the frontal tubercles, antennae, legs and body beneath pale, elytra with metallic blue-green markings consisting of a circle in the basal part and a semicircle in apical half.

Head with interocular space fully one-half width of head, occiput finely punctate, a median depression over the frontal tubercles, a well developed carina down lower front, occiput deep brown to the frontal tubercles, lower front pale, jaws tipped with brown. Antennae entirely pale. Prothorax broad and with rounded sides, a deep rounded depression on each side but not much evidence of a transverse

sulcus otherwise, impunctate, shining, pale yellow brown. Scutellum pale. Elytra coarsely punctate with the punctures irregularly geminate striate and below the middle becoming larger and somewhat ridged; the bluish-green markings in the form of a large circle in basal half and a semicircle in the apical half on each elytron. Body beneath and legs entirely pale. Length 4.5–6 mm.; width 2.2–3 mm.

Type, female, BMNH; one paratype, female, Bowditch collection, MCZ; both from Acapulco, Guerrero, Mexico, collected by Höge.

Remarks: Only two specimens of this species have been examined, both of the original Jacoby material. The type in the British Museum has a heavier, thicker dark ring on the elytra, with the pale space within considerably smaller than in the MCZ specimen. The very coarsely punctate elytra distinguish this species.

Neobrotica quadriplagiata Jacoby

FIGURE 26

Neobrotica quadriplagiata Jacoby, *in* Godman and Salvin, Biologia Centrali-Americana, Coleoptera, vol. 6, pt. 1, p. 546, 1887.

About 4½ mm. in length, oblong oval, shining although alutaceous, the prothorax very lightly sulcate, the elytra with a trace of lateral costa, head, tibiae, tarsi and breast dark, antennae bicolored, elytra dark with a faint violaceous gleam, the margin and apex pale and a large pale spot at base and another near apex opening widely behind into the pale apex.

Head with interocular space a little less than half width of head, frontal tubercles, carina and area about it brownish, the rest of head piceous. Antennae with the four basal and three apical joints pale, the intermediate ones dark. Prothorax with the sulcus across most evident at the ends; surface shining, finely punctate, sides slightly curved, pale yellow brown. Scutellum brownish. Elytra shrunken, probably an immature specimen, the sides a little narrowed, a trace of lateral costa; punctation not dense but distinct; the margins pale yellow and two pale roundish spots on each elytron, one near the base, the other at the apex, the apical one opening into and not distinct from the pale apex. Body beneath pale with the breast deep brown; femora pale, the tibiae and tarsi brownish. Length 4.5 mm.; width 2 mm.

Type, ?sex (the abdomen is hidden by the card on which the specimen is mounted), BMNH, from San Geronimo, Guatemala, collected by Champion.

Remarks: Only one specimen is known to the writer, and this is a poor, shrunken, immature one of undetermined sex, but quite distinct in its markings from any other species.

Neobrotica hondurensis Jacoby

FIGURE 13

Neobrotica hondurensis Jacoby, *in* Godman and Salvin, Biologia Centrali-Americana, Coleoptera, vol. 6, pt. 1, p. 577, 1887.

Between 6 and 7 mm. in length, oblong oval, moderately shiny, although alutaceous, the elytra faintly costate and with strong dense semistriate punctation; head, intermediate joints of the antennae, breast, tibiae and tarsi piceous, the thorax, femora and undersurface, except breast, pale; elytra pale with piceous basal, median and apical fasciae, the basal fascia sometimes partly joined with the median and the apical fascia usually with a long narrow indented pale area at the apical end.

Head with interocular space less than half width of head, frontal tubercles distinct with a median depression above, occiput finely punctate, a narrow carina running down lower front, entirely dark and shiny. Antennae with basal joints reddish brown, intermediate joints dark, the three terminal joints pale yellow. Prothorax a little wider than long with slightly curved sides and well-marked transverse sulcus, surface faintly alutaceous, finely punctate, entirely pale. Scutellum deep reddish brown. Elytra faintly costate, alutaceous and strongly punctate, a piceous fascia across base, sometimes connected at sides or in irregular toothlike projections with a broad median dark fascia, a third fascia at apex, having a long narrow concavity toward the apex, apex and margin pale. Body beneath pale with the breast piceous, femora pale, tibiae and tarsi dark. Anterior coxal cavities open, hind tibiae with a spine, claws appendiculate. Length 6–7 mm.; width 3.3–3.8 mm.

Type, female, BMNH; one paratype female, BMNH; one paratype, male, MCZ; all from Rio Hondo, British Honduras, collected by Blancaneau.

Other localities: Pancina and Cubilguitz, Vera Paz, Guatemala, Champion, collector; Cacao, Trece Agua, Alta Vera Paz, Guatemala, Barber and Schwarz, collectors.

Remarks: This is an unusually dark and heavily marked species and easily recognized.

Neobrotica simulans Jacoby

FIGURE 14

Neobrotica simulans Jacoby, *in* Godman and Salvin, Biologia Centrali-Americana, Coleoptera, vol. 6, pt. 1, p. 577, 1887.

About 5.5 mm. in length, oblong oval, somewhat shiny, although alutaceous, the elytra faintly costate and with strong, moderately dense semistriate punctures; head, intermediate joints of antennae and breast piceous, a piceous fascia on elytra divided narrowly by a

pale yellow irregular fascia from another wider dark fascia extending to a little below the middle, not quite meeting at the suture; before the apex another broad dark fascia having an oblong pale spot in the middle, apex and margin pale; legs pale, antennae pale with dark intermediate joints.

Head with interocular space less than half width of head, tubercles distinct and a depressed spot above them, a narrow carina down lower front; occiput smooth, very finely punctate, shining, black, except the tubercles which are brownish. Antennae pale with the fifth to ninth joints brown. Prothorax not twice as broad as long with only slightly curved sides, a deep transverse sulcus; surface although alutaceous shiny, very finely punctate, pale yellow. Scutellum pale. Elytra wider behind the middle, faintly costate, alutaceous but shiny, punctation strong, moderately dense, tending to be striate; pale yellow with a dark basal fascia, another broader one before the middle, an apical one enclosing an oblong pale spot in the middle of it, margin and apex pale. Body beneath pale, except the breast which is piceous. Length 5.5 mm.; width 2.7 mm.

Type, male, BMNH, from Chacoj in Vera Paz, Guatemala, collected by Champion.

Remarks: Only one specimen of this is known, the type. *N. simulans* is similar in markings to *N. hondurensis*; the only distinguishing marks are the pale tibiae and tarsi which are dark in *N. hondurensis*, and the slightly different color of the antennae. Possibly it may be only a color form of *N. hondurensis*.

Neobrotica pterota, new species

FIGURE 15

About 6.5 mm. in length, elongate oblong oval, shining, the elytra densely and coarsely punctate, the punctures tending to be striate, feebly costate along the side, pale yellowish brown, the head piceous on occiput, pale in front, antennae with pale basal joints, the terminal joints missing; elytra with a dark brown band enclosing a round pale spot on each elytron, and extending down along the side not quite joining with another narrower band that extends narrowly down the suture and down the side.

Head with interocular space less than half width of head, occiput shining piceous with fine punctures, a depression over the frontal tubercles which are tan colored, a carina down lower front which is pale, the mouthparts dark. Antennae with the terminal joints missing, the four basal ones pale, rest dark. Prothorax with curved sides and transverse sulcus, finely punctate, yellowish brown. Scutellum dark brown. Elytra with dense, moderately coarse, semistriate punctures, feebly costate along the side, pale yellow with a

wide dark brown basal fascia extending along the side, and enclosing a round pale median spot, suture narrowly dark and below the middle another narrower irregular fascia extending along the side and down the suture and almost connecting with the basal fascia along the side. Body beneath and femora pale yellow brown; breast, tibiae and tarsi dark; front tibiae and first tarsal joint in the male thickened, middle and hind tibiae with spine. Length 6.5 mm.; width 3.2 mm.

Type, male, BMNH, from Guatemala.

Remarks: The two chief characteristics of this species differentiating it from others are the coarse, dense elytral punctation and the dark brown color pattern on the elytra. The face is shorter than that of *N. hondurensis* Jacoby.

Neobrotica modesta Jacoby

FIGURE 35

Neobrotica modesta Jacoby, *in* Godman and Salvin, Biologia Centrali-Americana, Coleoptera, vol. 6, pt. 1, p. 579, 1887.

Between 5 and 6 mm. in length, elongate oblong oval, faintly shining, alutaceous, the elytra with feeble costae, occiput of head, tibiae and tarsi piceous, breast a little deeper brown, rest pale yellow brown.

Head with interocular space half width of head, occiput shining, piceous, finely punctate, a median depression over frontal tubercles, lower front with a narrow carina, entirely dark. Antennae with the basal two and apical three joints pale, rest deep brown. Prothorax not twice as wide as long with slightly curved sides, shining, very finely punctate, the transverse depression most marked at the ends, very shallow in the middle. Scutellum a little deeper yellow than elytra. Elytra faintly alutaceous, not very shiny, with three or four feeble costae, distinctly but not densely punctate, the punctures tending to be striate, entirely pale. In one specimen in the British Museum the elytra with a dark humeral spot. Body beneath pale, the breast a little darker brown and deep brown in one specimen, femora pale, tibiae and tarsi dark brown, almost piceous. Length 5–6.5 mm.; width 3–3.4 mm.

Type, female, MCZ; one paratype, female, BMNH; both from Tuxtla, Mexico, collected by Sallé. There is another specimen in the British Museum, determined by Jacoby, from "Mexico."

Remarks: This species has much the same coloration as *N. inconstans* Jacoby from Venezuela, but the elytral bare lines found in *inconstans* are not so marked. In the Mexican female specimen (without definite locality), the head has pale frontal tubercles and a pale lower front and there is a dark humeral spot on the elytra.

Neobrotica sexmaculata Jacoby

FIGURE 32

Neobrotica sexmaculata Jacoby, *in* Godman and Salvin, Biologia Centrali-Americana, Coleoptera, vol. 6, pt. 1, p. 578, 1887.

About 6.5 mm. in length, oblong oval, somewhat shiny, not at all slutaceous, the prothorax with a transverse sulcus, the elytra with many costae, the intervals being striate punctate, pale yellow, each elytron with six dark spots, slightly metallic violaceous, one on the humerus, one near the scutellum, a pair before the middle and a pair in line with them below the middle; antennae (except the last three joints), tibiae and tarsi dark.

Head with the interocular space about half the width of head, occiput finely punctate, a depression above the frontal tubercles, lower front almost flat, with a short broad carina only slightly raised, tips of mouthparts brownish. Antennae in the type specimen broken, the lower joints brown, ninth pale (in other specimens that correspond with the type the three last joints are pale). Prothorax almost rectangular, slightly rounded at the sides, the transverse sulcus across the middle well defined and deep; the surface shining, finely punctate, pale. Scutellum pale. Elytra with many costae between which the rows of punctures are deeply sunken either in a single row, sometimes geminate, or even alternate; each elytron with piceous spots having a faintly metallic violaceous lustre, one on the humerus, a small one between that and the scutellum near the base, a second row before the middle, one lateral, the other median, and a third row below the middle, one lateral, the other median. In the second specimen these spots are larger. Body beneath pale, the tibiae and tarsi brown. Length 6.5 mm.; width 3.3 mm.

Type, female BMNH, from Tlatingo, Mexico.

Remarks: Besides Jacoby's type from Tlatingo, Mexico, (Federal District), there are in the British Museum (Natural History) under that name three other specimens, only one of which closely resembles the type, and this one has the label "Mex." The other two specimens, one of which is labelled "Mex." are like the ones that I am describing from Matamoras, Mexico, as *Neobrotica matamorasensis*. In the unidentified material in the British Museum I have found two others like the type, one collected at Temascaltepec, circa 5000 ft., in 1913 by H. E. Hinton and R. L. Usinger, and one collected at Cuernavaca by Hinton. There is one in the U.S. National Nuseum from Cuernavaca collected in August by Krauss on the leaves of *Lantana*, and one in the California Academy of Sciences in the Fenyes collection from Cuernavaca, collected by Barrett.

N. sexmaculata is one of four closely related races, possibly species, that occur in Mexico and Arizona. Fall (Trans. American Ent.

Soc., vol. 36, p. 148, 1910) described the Arizona one under the name *N. pluristicta*. The one from Matamoras represents a race from the arid eastern area. A fourth race, represented by a single female collected by E. A. Schwarz at Tampico, is from the eastern coastal humid lowlands, and is the most divergent of the group. I am describing this as *N. tampicensis*.

Neobrotica pluristicta Fall

FIGURE 31

Neobrotica pluristicta Fall, Trans. American Ent. Soc., vol. 36, p. 148, 1910.

About 5.5 mm in length, oblong oval, somewhat shiny, the prothorax with a transverse sulcus, the elytra strongly costate with the intervals geminate striate punctate, pale yellow brown; each elytron has 7 spots: one on the humerus, another midway down the side and one at the apical curve, a second line of spots on the disk with the one nearest the apex having a smaller one beside it; the tibiae and tarsi dark, the antennae brown with the basal and terminal three joints usually paler.

Head with the interocular space a little more than half width of head, vertex densely and rather coarsely punctate, the cheeks on either side of the short carina also punctate, mouthparts edged with brown. Antennae sometimes entirely brownish, but often with the three basal and three terminal joints paler. Prothorax with rounded sides, more or less distinct transverse sulcus, alutaceous, finely punctate, pale yellow. Scutellum pale. Elytra distinctly costate, the intervals being coarsely and striately punctate, not very shiny, yellow brown with four spots across the base, four across the middle and six near the apex. Body beneath pale, the front tibiae dark on the outside, the other tibiae and all tarsi dark. Anterior coxal cavities open, claws appendiculate. Length 6–6.5 mm.; width 3.3 mm.

Type, Fall collection, MCZ, from Baboquivari Mts., Ariz., also collected in Santa Rita Mts., July 12–24, 1915, by Dury; Nogales, St. Cruz Co., collected by F. W. Nunenmacher, April 14, 1906; Penna Blanca, Ariz., collected by Lindsay, July 2, 1944, on *Chilopsis linearis*.

Remarks: This species while very much like *N. sexmaculata* Jacoby from the Federal District, Mexico, is smaller and not quite so coarsely punctate and the elytral costae are a little more distinct. The elytral spots are slightly different too. Whether it is a distinct species or only a geographic race is uncertain.

Neobrotica matamorasensis, new species

FIGURE 33

Between 6.5 and 7 mm. in length, oblong oval, not very shiny, the

elytra coarsely, striately and contiguously punctate, pale yellow brown, the elytra each with seven small spots.

Head with the interocular space more than half the width of head, vertex coarsely and densely punctate, a short carina down the front, cheeks coarsely and densely punctate, all pale yellow except the brownish mouthparts. Antennae brownish, sometimes the three basal and three terminal joints paler. Prothorax with rounded sides and transversely sulcate, pale, finely punctate. Scutellum pale. Elytra each with seven dark spots, the punctation coarse, contiguous and striate. Body beneath pale with the tibiae and tarsi dark. Length 6.6–7 mm.; width 3.4–3.5 mm.

Type, male, Bowditch collection, MCZ 30674, from Matamoras, Mexico, collected in May; two paratypes, Fenyes collection, CAS, bearing similar labels of Matamoras and May; one paratype, USNM without locality label.

Remarks: The three specimens from Matamoras, Mexico, are larger than the Arizona *N. pluristicta* Fall and are more coarsely punctate, the punctures being contiguous. The elytral spotting is also a little different. Whether this eastern form is really a species distinct from the Arizona *pluristicta* and the central Mexican *sexmaculata* is uncertain, but the elytral sculpture appears different from either the other two.

***Neobrotica tampicensis*, new species**

FIGURE 29

About 5.5 mm. in length, oblong oval, shining, the elytra distinctly and yet not coarsely punctate, feebly costate in the middle, yellow brown, the antennae except the four basal joints, reddish brown, each elytron with a dark humeral spot, a spot at suture by the scutellum, two spots, one lateral the other median, before the middle, and two after the middle; legs with tibiae and tarsi dark, breast shining piceous.

Head with interocular space more than half width of head; pale reddish brown over occiput, front paler yellow; tubercles well marked, a carina down lower front. Antennae with the four basal joints pale yellow, the rest reddish brown. Prothorax with a transverse sulcus, shining, pale reddish brown. Scutellum pale. Elytra wider towards apex, shining, feebly costate in the middle, distinctly but not coarsely punctate, the punctures not dense and tending to be striate near base, markings as above. Body beneath pale with the breast shining piceous, tibiae and tarsi dark. Length 5.3 mm.; width 2.9 mm.

Type, female, USNM 66843, Tampico, Mexico, collected by E. A. Schwarz.

Remarks: This is the most distinctively different one of the *sexmaculata* group. The coloring is different in that the breast is piceous and the elytral spots slightly differently located, especially the one near

the scutellum. The sculpture is unlike that of the rest, the elytra being less costate and rather finely and sparsely punctate.

Neobrotica semicostata Jacoby

FIGURE 36

Neobrotica semicostata Jacoby, *in* Godman and Salvin, Biologia Centrali-Americana, Coleoptera, vol. 6, pt. 1, p. 574, 1887.

About 6.5 mm. in length, elongate oblong oval, wider at the apical end, dull, not shining, the elytra with many costae, the intervals being coarsely geminate striate punctate, entirely pale.

Head with interocular space half its width, a depression above the frontal tubercles, occiput finely punctate and alutaceous, lower front coarsely punctate on each side of the carina, a little pubescent, the tips of the mandibles piceous. Antennae entirely yellow brown with the three apical joints pale yellow. Prothorax almost rectangular with slightly curved sides, a deep sulcus across the middle, surface alutaceous, finely punctate, pale. Scutellum pale. Elytra widened below the middle, irregularly costate, the intervals with deep coarse geminate punctures. Body beneath pale, legs pale, the claws a little deeper in color. Length 6.7 mm.; width 3.5 mm.

Type, female, BMNH, from Panistlahuaca, Mexico, collected by Sallé.

Remarks: This is clearly closely related to *Neobrotica pluristicta* Fall and *N. sexmaculata* Jacoby, but unlike them is without any dark marks or spotting. Only a single specimen is known to me.

Neobrotica pallescens Jacoby

FIGURE 34

Neobrotica pallescens Jacoby, *in* Godman and Salvin, Biologica Centrali-Americana, Coleoptera, vol. 6, pt. 1, p. 575, 1887.

About 7 mm. in length, elongate oblong oval, shining although faintly alutaceous, the elytra with numerous fairly distinct costae, with the intervals irregularly geminate striate punctate, pale yellowish brown with a piceous head, deeper brown intermediate joints of the antennae and brown tibiae and tarsi.

Head with interocular space half the width of head, a median depression over the frontal tubercles, a narrow carina running down the lower front, shining, impunctate, piceous except for the pale neck underneath. Antennae with paler basal and apical joints, intermediate ones deep brown. Prothorax much wider than long with rounded sides and a transverse sulcus, shining although feebly alutaceous and very finely and indistinctly punctate, entirely pale. Scutellum tan colored. Elytra with 8 or 9 more or less distinct costae, the interspaces irregularly geminate striate punctate, shining, although faintly

alutaceous, entirely pale. Body beneath entirely pale, femora pale, tibiae and tarsi deep brown, front, middle and hind tibiae with spine. Length 5.5–7 mm.; width 2.6–3.8 mm.

Type, female; one paratype, female; both Bowditch collection MCZ; two paratypes, females, BMNH; all from Rio Hondo, British Honduras, collected by Blancaneau.

Remarks: This species differs from the entirely pale species *Neobrotica semicostata* Jacoby, in having a dark head and darker tibiae and tarsi. All specimens examined are females and present a uniform appearance.

Neobrotica inconspicua Jacoby

FIGURE 40

Neobrotica inconspicua Jacoby, *in* Godman and Salvin, Biologia Centrali-Americana, Coleoptera, vol. 6, pt. 1, p. 576, 1887.

About 7½ mm. in length, elongate oblong oval, the elytra wider behind, faintly costate and rather densely and finely punctate, entirely pale above except for the reddish brown scutellum; the antennae, breast, tibiae and tarsi also reddish brown.

Head with the interocular space half width of head, frontal tubercles not prominent, a depression above with dense fine punctures in it, occiput sparsely and finely punctate, carina short and broad. Antennae with only five basal joints remaining, the first joint pale, the rest reddish brown. Prothorax with rounded sides and a transverse sulcus, pale, impunctate. Scutellum reddish brown. Elytra widened below the middle, very faintly costate, a well marked intrahumeral sulcus, the punctures not coarse but dense and confused. Body beneath pale, shiny, very lightly pubescent, breast pale reddish brown; legs pale with the tibiae and tarsi pale reddish brown. Length 7.8 mm.; width 4.2 mm.

Type, female, BMNH, from Cerro de Plumas, Mexico, collected by Höge.

Remarks: Only one specimen, the type, is known of this large pale species. As Jacoby wrote in his description, "the lower five joints of the antennae are piceous, the rest broken off." It is not so costate as *N. semicostata* Jacoby, also from Mexico.

Neobrotica decimsignata, new species

FIGURE 38

Between 8 and 10 mm. in length, elongate oblong oval, not shining, alutaceous, the elytra densely and confusedly punctate, not at all costate, pale yellow brown with the intermediate joints of the antennae darker, the elytra with ten dark spots, sometimes the two near the humerus confluent.

Head with interocular space a little less than half width of head, a median depression over the frontal tubercles, occiput alutaceous and finely punctate about the depression over the tubercles, a poorly defined and narrow carina down the lower front, lower front more densely punctate, head pale with the mouthparts edged with brown. Antennae long with the basal and apical joints pale, the intermediate ones brownish. Prothorax considerably wider than long with slightly curved sides and a shallow transverse depression, another shallow median depression anteriorly, surface alutaceous and finely punctate, entirely pale. Scutellum pale. Elytra with no signs of costae, densely, confusedly and rather coarsely punctate, pale yellow, each elytron with a piceous spot on the humerus and a smaller spot below it on the side, these two spots sometimes confluent, a large spot below the scutellum near the suture, a fourth spot on the side at the apical curve and a fifth spot near the suture and slightly above the apical curve spot. Body beneath and legs entirely pale, the middle and hind tibiae with a spine. Length 8.5–9.7 mm.; width 4.5–5 mm.

Type, male, USNM 66848, from near Cot, Costa Rica, collected by P. Knight, Sept. 22, 1937, on potato.

Other localities: Coronado, Costa Rica, 1400–1600m. Nevermann, collector; Carpentera, Costa Rica, Feb. 2, 1936, collected by Sofia and C. H. Ballou, on *Anona*.

Remarks: In coloration and sculpture this resembles the Peruvian species, *N. octosignata*, but the Peruvian species lacks the small spot on the side below the humerus; the antennae are not so long, and the first tarsal joints of the middle and hind legs are shorter. In *N. decimsignata* the antennae and the first tarsal joints of the middle legs are longer than in any of the other large spotted species.

***Neobrotica septemmaculata*, new species**

FIGURE 39

About 7 mm. in length, elongate oblong oval, not at all shiny, dull alutaceous, elytra with dense and rather shallow punctation, prothorax with a transverse sulcus most pronounced in the rounded depressions on each side; pale yellow brown, the head with a dark occiput and mouthparts, the antennae with pale basal and apical joints; the elytra with a small dark spot on the humerus and two in the middle on each elytron, one before the middle and one after the middle; front tibiae and first tarsal joint in male enlarged, the tibiae and tarsi more or less dark.

Head with interocular space less than half width of head, eyes large, frontal tubercles distinctly marked and a depression over them, carina short and distinct, occiput down to frontal tubercles piceous, lower front pale, mouthparts dark. Antennae not extending to the

middle of elytra, basal and terminal joints pale, intervening ones darker. Prothorax with slightly curved sides and a transverse sulcus most marked at each end in the form of a rounded depression; surface alutaceous, yellow brown. Scutellum reddish brown. Elytra wider behind the middle with traces of costae and with a short intrahumeral sulcus, not shiny, alutaceous, densely and shallowly punctate, pale yellow brown, a small dark spot on the humerus, another small spot before and one after the middle on each elytron. Body beneath pale, except the dark shiny piceous breast, femora pale, front tibiae of the male enlarged and first tarsal joint of the anterior legs in the male also enlarged, the front tibiae with a dark outer streak, the other tibiae and tarsi dark. Claws appendiculate, a spine at the end of the middle and hind tibiae. Length 7 mm.; width 3.5 mm.

Type, male, Bowditch collection, MCZ 30671, bearing locality label "Tex."

Remarks: This differs from the other large spotted species in having a dark occiput and large eyes, with the interocular space less than half the width of the head. It is possible that it differs from the others too in the greater enlargement of the front tibiae and first tarsal joint in the male, but since only one male is known of the other species this cannot be certain.

***Neobrotica pentaspilota*, new species**

FIGURE 37

About 7.5 mm. in length, elongate oblong oval, not very shiny, the elytra dull and alutaceous, densely punctate, with faint traces of costae, pale yellow, the intermediate joints of the antennae brownish, scutellum piceous; four tiny brown spots on each elytron, two before and two after the middle; tibiae and tarsi streaked with dark on the outside, breast deeper orange yellow.

Head with interocular space about half width of head, a median depression over frontal tubercles, occiput finely punctate, a narrow carina down lower front, upper part of head a deeper yellow in color, mouthparts edged with brown. Antennae with pale basal and apical joints, the intermediate ones dark brown. Prothorax wider than long with slightly rounded sides and a transverse sulcus, very finely punctate, shiny, pale yellow. Scutellum piceous. Elytra with numerous faint costae, irregularly and densely punctate, alutaceous, not shiny, pale yellow with four tiny brown spots on each elytron, two before and two after the middle. Body beneath pale with the breast deeper orange brown. Femora pale, the front tibiae on outside and the middle and hind tibiae more or less dark, all tibiae with spines. Length 7.5 mm.; width 3.6 mm.

782-220—66——3

Type, female, USNM 66849, taken on a Bromeliad at Laredo, Texas (port of entry), January 19.

Remarks: The locality from which this species comes is unknown as the single specimen was intercepted on entry into the United States at Laredo, Texas, of a shipment from south of Texas. It differs from the other large pale species with spots in that there is no humeral spot and the scutellum, tibiae and tarsi are dark.

Neobrotica quinquepunctata (Jacoby)

FIGURE 41

Diabrotica quinquepunctata Jacoby, *in* Godman and Salvin, Biologia Centrali-Americana, Coleoptera, vol. 6, pt. 1, p. 557, 1887.

About 7.5 mm. in length, elongate oblong oval, alutaceous, only feebly shining, the elytra with dense, shallow and rather coarse punctures, often contiguous; traces of costae, paler yellow brown with intermediate antennal joints a shade deeper and on the elytra ten small piceous spots.

Head with interocular space half width of head, a median depression above the clearly marked frontal tubercles, carina down front strong and not very long, head entirely pale. Antennae with basal four and apical three joints a little paler than intermediate ones, third antennal joint about equal to fourth. Prothorax with a deep transverse sulcus, sides rounded, surface feebly shining, a few punctures, pale yellow brown. Scutellum piceous. Elytra a little wider apically, densely, closely, and shallowly punctate, punctures not at all striate, often contiguous; faint traces of costae; pale yellow brown with a small dark humeral spot, two small spots before the middle, one lateral, the other median, and two spots after the middle in a line across, on each elytron. Body beneath and legs entirely pale, anterior coxal cavities open, the claws appendiculate although the inner tooth is longer and more slender than usual. Length 7.5 mm.; width 3.6 mm.

Type, female; two paratypes; all in Bowditch collection, MCZ, from Capetillo, Guatemala, collected by Champion, 1st Jacoby collection.

Remarks: Jacoby wrote that the "claws (were) bifid, the inner division rather short," but they are not bifid to the extent that is found in *Diabrotica;* the inner tooth, although unusually long and slender, is not nearly as long as the outer one. This clearly belongs to the group of large pale spotted species, and in its spotted elytral markings most resembles *N. pentaspilota;* but that species lacks the dark humeral spot and has darkened tibiae and tarsi. *N. septemmaculata* has a dark head and more closely set eyes.

Key to the South American Species of *Neobrotica*

1. Elytra entirely pale 2
   Elytra not entirely pale 3
2. Head, tibiae and tarsi dark piceous . . . . . **inconstans** Jacoby (p. 316)
   Head brown, tibiae and tarsi pale . . . . . **bowditchi** Bechyne (p. 319)
3. Elytra with broad reddish brown or piceous fasciae 4
   Elytra without broad fasciae 6
4. Elytra with two broad piceous fasciae separated by a narrow pale one below the middle . . . . . **flavolimbata,** new species (p. 314)
   Elytra with reddish brown fasciae 5
5. Elytra with a basal and apical fascia enclosing a small pale area in the middle. **hepatica** Bechyne (p. 314)
   Elytra with three fasciae, the apical one having a small pale inner area. **rogaguaensis,** new species (p. 315)
6. Elytra with a long lateral vitta from humerus to apical curve 7
   Elytra with shorter vittae or spots 8
7. Elytra with a median vitta . . . . . **atrilineata,** new name (p. 313)
   Elytra without median vitta . . . . . **rendalli,** new species (p. 311)
8. Occiput pale with a small median dark spot or spots 9
   Occiput pale or dark, without spots 10
9. Each elytron with a long lateral vitta from humerus to below middle and four other dark spots . . . . . **ebraea** (Fabricius) (p. 309)
   Each elytron without lateral vitta and with 6 spots **oblongopunctata** Jacoby (p. 308)
10. Elytra with a moderately wide dark sutural vitta extending nearly to apex, remnants of a median vitta . . . . . **stalagma,** new species (p. 312)
    Elytra with only a short sutural vitta or darkened sutural edges or none at all 11
11. Head entirely pale 12
    Head not entirely pale 16
12. Elytra dull, not at all shiny, rather coarsely punctate. **meridensis,** new species (p. 304)
    Elytra more or less shiny 13
13. Large, 6–8 mm. 14
    Smaller, 5–6 mm. 15
14. Each elytron with 4 large spots, with one just below scutellum, near suture. **octosignata,** new species (p. 320)
    Each elytron with 4 spots, one before the middle and not near suture. **grandis,** new species (p. 321)
15. Elytra with the spot before the middle narrowly horizontal, Trinidad. **praeclara** (Weise) (p. 306)
    Elytra with the spot before the middle not narrowly horizontal, markings usually pale reddish brown . . . . . **dimidiaticornis** Jacoby (p. 305)
16. Head dark over occiput but with the front usually paler 17
    Head entirely dark 27
17. Head with area about eyes dark . . . . . **dimidiaticornis** Jacoby (p. 305)
    Occiput down to frontal tubercles entirely dark 18
18. Elytra not at all costate 19
    Elytra with traces of costae 23
19. Large, about 6–7 mm. or more 20
    Smaller, about 5–5.5 mm. 21

20. Elytra pale, each with only a small humeral spot and a small spot before the middle . . . . . **quadrimaculata**, new species (p. 322)
Elytra pale, each with a humeral spot and a spot before and usually 2 after the middle . . . . . **colombiensis**, new species (p. 303)
21. Tibiae with dark outer streak . . . . . **erythrinae** Bechyne (p. 318)
Tibiae entirely pale 22
22. Elytra with dark basal marking across base to suture and running down side to apex, widening before and after the middle.
regularis, new species (p. 319)
Elytra with a dark humeral and sutural mark and spots at apex.
ruficollis, new species (p. 311)
23. Elytra with dark humeri, a short dark sutural vitta and 2 apical spots, but no spots before the middle . . . . . **comma** Bechyne (p. 310)
Elytra with spots and even a fascia before the middle 24
24. Legs with tibiae and tarsi dark . . . . . **poecila**, new species (p. 305)
Legs pale 25
25. Median spot before the middle straight and horizontal.
praeclara (Weise) (p. 306)
Median spot before middle more or less curved 26
26. Large, 6–7.5 mm. . . . . **flavipes**, new species (p. 302)
Small, 5.5 mm. . . . . **germaini**, new species (p. 317)
27. Larger, 6–7.5 mm. . . . . **flavipes**, new species (p. 302)
Smaller, 5.5 mm. . . . . **dimidiaticornis** Jacoby (p. 305)

Neobrotica flavipes, new species

FIGURE 49

Neobrotica variabilis Jacoby, Proc. Zool. Soc. London, p. 286, 1889. [Not *variabilis*.]

Between 6 and 7.5 mm. in length, elongate oblong oval, somewhat shiny, finely alutaceous, the elytra distinctly punctate and feebly costate, head usually dark but often with a pale front; antennae, pronotum, legs and undersurface except breast pale yellow; elytra pale with dark humeri and a dark line about scutellum extending down suture and often connecting in a loose circle with a dark line from humerus which curves down and across elytron; at the apex another semilunate dark marking often broken into two spots.

Head with the interocular space a little less than half the width of the head, frontal tubercles well marked and with a median depression above, a narrow carina down lower front; occiput finely punctate, usually dark to the antennal sockets with the lower face pale, but not always so, the mouthparts dark. Antennae entirely pale. Prothorax not twice as wide as long with slightly curved sides and a transverse sulcus, finely alutaceous and finely punctate, entirely pale. Scutellum pale or tan colored. Elytra with traces of costae along the sides, feebly shining, finely alutaceous, punctation distinct and tending to be geminate striate. In the Corozal specimen the piceous markings on the elytra from the humerus do not connect along the side with a transverse fascia, a piceous dark mark around the scutellum and down

the suture joining with the transverse fascia, in other specimens a complete loose ring of these dark markings; at the apex, the piceous marks semilunate and more or less connected. Body beneath pale with the breast shining dark brown or piceous; legs entirely pale, middle and hind tibiae with a spine, anterior coxal cavities open, claws appendiculate. Length 6–7.5 mm.; width 3.2–3.7 mm.

Type, female, MCZ 30664, from Corozal, Venezuela.

Other localities: El Valle, D.F., Venezuela, on *Zea mays* Linnaeus, H. Pérez, collector; Huila, Colombia, B. Losadas, collector; Rio Dagua, Colombia, W. Rosenberg, collector.

Remarks: Although only female specimens have been examined, the writer believes the species is distinct from *N. variabilis*, the type of which comes from Jalapa, Mexico. These beetles differ from the Mexican ones in the color of the legs and antennae which in the Mexican species are more or less dark. Both species have similar elytral markings but these markings are common to many species of the genus.

***Neobrotica colombiensis*, new species**

FIGURE 63

Between 6 and 7 mm. in length, elongate oblong oval, faintly shining, alutaceous, the elytra finely punctate, pale yellowish brown, the occiput of the head deeper brown, antennae pale with the intermediate joints deep brown; elytra with piceous spots, one on the humerus, a narrow dark edging about the scutellum and down the suture a little way, on each elytron a transverse spot not reaching the suture before the middle, and two spots after the middle, one on the side, one in the middle; legs pale, body beneath pale with the breast dark.

Head with the interocular space not quite half width of head, occiput alutaceous and finely punctate, a brown spot, sometimes widening to cover the occiput down to the frontal tubercles, from tubercles to mouthparts yellow brown, mouthparts tending to be brownish, a median depression over the frontal tubercles, a short, well defined carina down lower front. Antennae with the basal four joints yellowish brown, joints five to eight deep brown, nine to eleven pale yellow, tip of apical joint dark. Prothorax somewhat wider than long with nearly straight sides and a shallow transverse depression, surface alutaceous and finely punctate, entirely pale. Scutellum dark brown or piceous. Elytra wider in lower half, feebly shining, alutaceous and finely punctate, pale yellow brown with a piceous spot on the humerus, a narrow piceous edging about scutellum and down the suture a short way, on each elytron a transverse fascia or spot from near the margin, not reaching the suture, before the middle, and two spots near the apex, one near the margin, and the other larger and median. In some fresh specimens there is a deeper orange coloring in the apical

half of the elytra. Body beneath pale with the breast piceous; legs entirely pale, in one specimen the front tibiae with a dark streak, middle and hind tibiae with a spine, front tibiae in the male somewhat stouter. Length 6.1 mm.; width 3.3–3.5 mm.

Type, female, USNM 67136, from 3 miles north of Villacencia, Meta, Colombia, 92 m., collected March 11, 1955, by E. I. Schlinger and E. S. Ross.

Other localities: Bogotà; Cayenne, Venezuela.

Remarks: The markings of this species resemble those of many of the small and usually costate species. This is one of the larger species with little trace of costae on the elytra.

***Neobrotica meridensis*, new species**

FIGURE 53

About 6.5 mm. in length, elongate oblong oval, dull, not at all shiny, the elytra coarsely and densely punctate, faintly costate in some specimens, pale yellow brown with reddish brown to piceous elytral markings, the breast a little more brownish.

Head with the interocular space less than half width of head, eyes prominent, tubercles clearly marked with a well defined median depression over them, occiput densely punctate about this depression, carina clearly distinct down the front, occiput often tan colored or even darker, lower front pale, labrum usually piceous. Antennae pale but in some darker specimens becoming brownish towards apex. Prothorax with the sides nearly straight, the transverse sulcus not deep in most specimens, most clearly defined at the ends, surface alutaceous and finely punctate, pale yellow. Scutellum pale. Elytra with a short intrahumeral sulcus; in some specimens traces of costae with the punctation between tending to be geminate, and rather coarse; surface dull, not at all shiny, pale yellow with deep brown to piceous markings that are variable in extent, in the most heavily marked specimens with nearly a circle in the basal half, and a lunate shaped mark opening towards the apex in apical half; these marks present in a lesser degree, sometimes consisting only of a humeral spot and a spot in the middle at base and another near the apex on each elytron. Body beneath usually with the breast a little browner, legs entirely pale. Length 6–7.4 mm.; width 2.8–3.7 mm.

Type: male; eight paratypes; Bowditch collection, USNM 66844, all from Merida, Venezuela; two paratypes, MCZ; two paratypes, BMNH; these probably of the same series as Bowditch, who may have had these from the Jacoby collection. One specimen in the Museum of Comparative Zoology is very pale with some of the spots missing, and this was placed under *N. dimidiaticornis*.

Remarks: This species is readily distinguished from others of similar markings by its dull, coarsely punctate elytra. In this respect it resembles *N. pluristicta* Fall, but the latter species is much more definitely costate.

***Neobrotica poecila*, new species**

FIGURE 45

About 5.5 mm. in length, elongate oblong oval, alutaceous, not very shiny, the elytra rather densely but not coarsely punctate, and with faint costae, pale yellow brown; the occiput, intermediate joints of the antennae, tibiae and tarsi, and the middle of the breast brown; the elytra with small piceous spots on the humerus, about the scutellum, two in a line down the middle and two along the side of each elytron.

Head with the interocular space about half width of head, occiput smooth except for the fine punctures about the median depression above the frontal tubercles, carina thin and not greatly elevated, occiput dark, lower front pale. Antennae pale with joints five to eight piceous. Prothorax not much wider than long, with the usual transverse sulcus well marked, sides slightly curved, alutaceous, pale yellow. Scutellum brownish. Elytra with traces of three or four costae, distinctly but not coarsely punctate, alutaceous, not shiny, pale with a small piceous spot on humerus, another surrounding the scutellum, two in a line down the middle and two along the side of each elytron. Body beneath pale with the middle of the breast brownish; femora pale, tibiae and tarsi mostly deeper brown. Length 5.5 mm.; width 2.8 mm.

Type, male, MCZ 30666, from "Brazil."

Remarks: The elytral pattern is similar to many species of *Neobrotica* from Central America. There is one specimen without locality label in the U.S. National Museum, a gift from the Bowditch collection.

***Neobrotica dimidiaticornis* Jacoby**

FIGURES 56, 59

Neobrotica dimidiaticornis Jacoby, Proc. Zool. Soc. London, p. 285, 1889.

Between 5 and 7 mm. in length, elongate oblong oval, feebly shining, alutaceous, pale yellow brown with darker markings on the vertex, the intermediate joints of the antennae and spots or short vittate markings on the elytra, undersurface and legs entirely pale.

Head with interocular space less than half width of head, frontal tubercles swollen, a median depression above, occiput smooth, a narrow carina down lower front; occiput more or less piceous and mouthparts brownish. Antennae pale with the intermediate joints usually darker, sometimes nearly piceous, or in one specimen only

faintly brown. Prothorax not so long as wide with nearly straight sides and transverse sulcus across the pronotum, shining, finely punctate, pale yellow brown. Scutellum brown or piceous. Elytra with a small costa running down from humerus, sometimes traces of other lateral costae; finely punctate and finely alutaceous, pale yellow brown with variable pale reddish brown, sometimes piceous, each elytron with markings consisting of a spot on the humerus, another on the side below this and another on the side near the apex, two median ones, one before and the other after the middle; these last spots often absent in part or coalescing along the side, and forming short vittae. Body beneath and legs entirely pale, a spine on middle and hind tibiae, front tibiae of the male enlarged. Length 5.3–6.8 mm.; width 2.4–2.9 mm.

Type, male; one paratype; both in MCZ, from Caracas, Venezuela.

Remarks: In the Bowditch collection are four specimens, two from Caracas, one from San Esteban, collected by E. Simon, and one with no locality label. These are undoubtedly the specimens named by Jacoby in his original description, as *N. dimidiaticornis*; even the markings correspond with the variety having "spots or streaks." There are no specimens from Venezuela in the British Museum collection, but there is a male from Colombia, which is labelled by Jacoby as *Diabrotica piceolimbata* Baly; however it does not correspond with Baly's description of *piceolimbata*, and Jacoby's label should be disregarded. In the U.S. National Museum are other specimens of this species from Caracas collected by A. J. C. Rojas, and specimens from El Valle (near Caracas) collected by C.H. Ballou on *Paponax* and *Crescentia cujete*. There is a great variation in the two series in the elytral markings in that the spots frequently are elongated and coalesce, forming short vittae along the side, in the middle, and below the scutellum along the suture. The markings usually pale reddish brown become piceous brown in some darker specimens. The beetles differ from *N. ebraea* in having a dark piceous or brown occiput. In the latter species there is only a middle dark spot on the vertex.

Neobrotica praeclara (Weise)

FIGURE 47

Cerotoma praeclara Weise, Zool. Jahrb., suppl. 16, pp. 15–16, 1929.

Neobrotica dimidiaticornis praeclara.—Bechyne, Ent. Arb. Mus. G. Frey, vol. 7, no. 1, p. 316, 1956.

About 5.5 mm. in length, elongate oblong oval, feebly shining, alutaceous, the elytra strongly and densely punctate with a tendency to being geminate striate between the feeble costae, pale yellow, the

breast darker, elytral spots with a faint metallic lustre: a spot on the humerus, one about the scutellum, one on the side below the humerus, and a horizontal one before the middle, and one on the side and another in the middle near apex on each elytron.

Head with interocular space less than half width of head, frontal tubercles distinct and a median depression above them, occiput smooth, alutaceous, minutely punctate, a narrow carina down the front; entirely pale in some specimens, brown to piceous in others. Antennae pale. Prothorax not twice as wide as long with slightly rounded sides and a transverse sulcus, shining, very finely and indistinctly punctate, pale. Scutellum pale. Elytra alutaceous with strong dense punctation tending to be geminate striate between the feeble costae, pale yellow with dark markings usually with a violaceous lustre and consisting of a dark humeral spot, sometimes united across the base with a dark area about scutellum, the latter extending down the suture a little way but not meeting the transverse short fascia below; this fascia sometimes broken into a short horizontal mark and a lateral spot, near the apex a median and lateral spot, sometimes united in a semilunate mark. Body beneath and legs pale, the breast deeper brown, the anterior tibiae in male enlarged. Length 5.4–5.9 mm.; width 2.7–3 mm.

Type, whereabouts unknown, from Trinidad.

Other localities: Montserrat, Trinidad, collected by Augustus Busck, June 1903; Cocoa estate about six miles from LaBrea, Oct. 18, 1918, collected by H. Morrison; Dept. Agriculture grounds, Port-O-Spain, November 1918, collected by H. Morrison; Tobago Island, collected by A. Busck.

Remarks: In the Bowditch collection specimens of this species have been placed under *N. coeruleolineata* Jacoby, which is found in Mexico and Guatemala and has similar elytral markings. In the British Museum (Natural History) is a series of seven specimens, all from Trinidad and very constant in markings, that is labelled by Gahan with the manuscript name *trinitatis*. Bechyne has labelled the one specimen in the Frey museum, also from Trinidad, as *Neobrotica dimidiaticornis praeclara* Weise, a new combination for *Cerotoma praeclara* Weise. Although I have not examined the type, Weise's detailed description fits this species, and in particular his description of the distinguishing mark in the elytral spotting of this species, "the 2 and 3 spots lie in a straight cross row", applies to this species and not to *dimidiaticornis*. The species appears to be confined to Trinidad and Tobago Island.

Neobrotica oblongopunctata (Jacoby)

FIGURE 54

Diabrotica oblongopunctata Jacoby, Cist. Ent., vol. 3, no. 26, p. 46, 1882.
Diabrotica nigroguttata Baly, Journ. Linnaean Soc. Zool., vol. 19, p. 243, 1886.

Between 7 and 8 mm. in length, elongate oblong oval, somewhat shiny although alutaceous, the elytra densely and shallowly punctate with faint lateral costae; pale yellow, the head with a spot on the occiput, sometimes two other spots at the very base of the occiput; elytra with three spots along the side of each elytron and three in the middle.

Head with the interocular space about half width of head, frontal tubercles a little swollen, a small median depression above them and a narrow carina running down the lower front, occiput smoothly rounded, sometimes with a few punctures, pale yellow with a small brown spot in the middle at base and when the head is protruded a smaller spot visible on each side; mouthparts edged with brown. Antennae pale with the basal and apical joints a shade lighter, tip of terminal joint black. Prothorax about a third wider than long with sides slightly rounded and with a transverse depression, finely punctate. Scutellum brown. Elytra faintly alutaceous, shining, with fine, dense and semistriate punctation, pale, each elytron with elongate brown spots, one on the humerus, a second along the side not connected with the humeral spot, and a third at apical curve, in the middle of each elytron one below the scutellum, a second before the middle, and a third after the middle. Body beneath and legs entirely pale, the breast a shade deeper in coloring, middle and hind tibiae with a spine. Length 6.7–8 mm.; width 2.5–4 mm.

Type, in Bowditch collection, MCZ from Caracas, Venezuela; probably several paratypes as some specimens beside the type are labelled "Caracas".

Other localities: Juan Mina, Canal Zone, collected by R. S. Shannon, Sept. 2, 1923, Pecora, Panama, collected Feb. 10, 1945, by H. H. Stage; Para Graso Mindi Dairy Farm, Mindi, Panama, collected by H. F. Dietz; Trinidad, collected by F. W. Urich and A. Busck; Cocoa Estate, about 6 miles from LaBrea, Trinidad, collected by H. Morrison, Oct. 18, 1918; Caracas, Venezuela; Mompos, Nare (on the Magdalena River), Colombia.

Remarks: In the Bowditch collection is a specimen from Caracas bearing the label *nigroguttata* Baly and beneath that the label *oblongopunctata* Jacoby. It seems likely that this is the original Jacoby specimen described by Jacoby from Caracas in 1882. Dr. Selman writes that there are no specimens of *Diabrotica oblongopunctata* Jacoby in the British Museum. There is on one specimen an old Chevrolat green label with the name "*Diabrotica oblongonotata* Chev."

which Dr. Selman has compared with *nigroguttata* and concluded they are synonymous. There is one labelled "*Diabrotica oblongoguttata* Chev." in the same series with the same sort of green label. In addition to these confusing old names, the species has been confused with *Neobrotica ebraea* (Fabricius) which it strongly resembles in its markings. It is, however, a little larger, the eyes are not so closely placed, the elytral punctation is more distinct, and there are traces of costae and the aedeagus is different, too. On the occiput the spot is smaller in *N. oblongopunctata* and there are two smaller spots visible when the head is protruded. On the elytra the humeral spot does not coalesce with the lateral spot below it. It is also similar in elytral markings to *Diabrotica significata* Gahan but lacks the two vittate marks on the prothorax.

Neobrotica ebraea (Fabricius)

FIGURE 58

Crioceris ebraea Fabricius, Mant. Ins., vol. 1, p. 89, 1787; Ent. Syst., vol. 1, pt. 2, p. 8, 1792; Syst. Eleuth., vol. 1, p. 459, 1801.

Cryptocephalus (*Crioceris*) *ebraeus*.—Gmelin, Systema naturae, ed. Linn., vol. 1, pt. 4, p. 1721, 1790.

Galeruca hebraea.—Olivier, Entomologie, vol. 6, p. 656, 1808.

Neobrotica ebraea.—Weise, *in* Schenkling, Coleopterorum catalogus, pt. 78, p. 103, 1924.

Between 5 and 6 mm. in length, elongate oblong oval, shiny, faintly alutaceous, the elytra very finely punctate; head pale with a triangular dark spot in the middle of the occiput, dark mouthparts; the thorax, legs and undersurface pale; elytra with an elongate piceous marking extending from the humerus to below the middle, an elongate spot near the middle of base of elytron and one before and one after the middle and one laterally near the apical curve.

Head with the interocular space less than half width of head, frontal tubercles swollen, a median depression above and a narrow carina down the lower front, occiput smooth and shining, head pale except for a triangular piceous spot in middle of base of occiput, and dark mouthparts. Antennae entirely pale except tip. Prothorax wider than long with nearly straight sides, a shallow transverse depression, pale, shiny, nearly impunctate. Scutellum dark. Elytra shiny, faintly alutaceous, very finely punctate, pale with markings as described above. Body beneath and legs usually entirely pale, anterior coxal cavities open, a spine on the middle and hind tibiae, the first tarsal joint and anterior tibiae of the male swollen. Length 5–5.9 mm.; width 2.5–3 mm.

Type, whereabouts not known, from Cayenne, French Guiana.

Other localities: Para, Bahia, Brazil; Rustenwerk, Surinam (Dutch Guiana), on cacao, collected by D. C. Geyskes; Cayenne, French

Guiana, collected by W. Schaus; San Rafael, Trinidad, collected by Adamson; Caucagua, Venezuela, on cacao, collected by Ed. Miranda; Caracas, Venezuela.

Remarks: The distinguishing mark of this species is the elongated spot extending from the humerus down the side of the elytron, which is broken into two spots in *N. oblongopunctata* (Jacoby).

Neobrotica comma Bechyne

FIGURE 50

Neobrotica comma Bechyne, Ent. Arb. Mus. G. Frey, vol. 7, no. 1, p. 316, 1956.
Neobrotica comma ssp. *additionalis*.—Bechyne, Ent. Arb. Mus. G. Frey, vol. 7, no. 1, p. 317, 1965.

From 6 to 7.5 mm. in length, elongate oblong oval, somewhat shiny, although alutaceous, the elytra very finely punctate and with traces of costae, pale yellow brown, the head piceous to antennal sockets, lower front pale, mouthparts dark; legs and antennae pale, breast dark; elytra with dark humeri, a narrow dark area about scutellum and dark a little way down the suture, on each elytron two subapical dark spots, one on the side, one in the middle; front tibiae and first tarsal joint of the male enlarged.

Head with interocular space less than half width of head, occiput alutaceous and very finely punctate, a median depression over the frontal tubercles, carina only visible a short way down lower front, the lower front pale, mouthparts and occiput dark. Antennae entirely pale. Prothorax somewhat wider than long with slightly curved sides and a transverse sulcus, shining, very finely punctate, pale yellow brown. Scutellum tan colored. Elytra finely alutaceous and distinctly and densely punctate, the punctation tending to be striate and with traces of four or five costae on each elytron, more apparent in the male; pale yellow with elongate piceous markings, sometimes with a greenish lustre, over the humeri, about the scutellum and down the suture and two elongate dark spots near the apex, one on the side and the other near the middle of each elytron. Body beneath pale except the shiny piceous breast, legs entirely pale. Length 6–7.5 mm.; width 3–3.5 mm.

Type, female, in G. Frey Museum, from Coroica, Bolivia.

Other localities: Yungas, tropical region, Chapare, 4000 m., Bolivia, collected by Zischka and E. W. Reitter; Cochabamba, Bolivia, collected by Germain; Huallaga, Tocache, Peru, collected by C. A. Baer; Monson Valley, Tingo Maria, Peru, October–December 1954, collected by E. I. Schlinger and E. S. Ross; Valley Chanchamayo, Peru, 800 m., collected by Weyrauch, August 1951; Colombia, Rio Juntes, Brazil.

Remarks: In Bechyne's subspecies of this genus, *additionalis*, described from specimens from Callanga, Peru, there is another line in

the middle of the base of the elytra. This may not be the same species, but since it is described from a female, one cannot determine the exact status. Bechyne includes under this subspecies a specimen from Puno, Peru, which is also a female with an extra line, and two others, one from Sicuani, Peru, and the other from Tingo Maria, Peru, both without the line and similar to the type of *comma*. I have examined a large series from Tingo Maria and all are without this additional line. In fact, the markings are remarkably constant. The species seems to be widespread, occurring from Colombia to Bolivia and eastward into Brazil.

***Neobrotica ruficollis*, new species**

FIGURE 44

About 6 mm. in length, elongate oblong oval, shining although faintly alutaceous, the elytra densely but not coarsely punctate, not costate, pale yellow with the occiput, mandibles, antennal joints six to eight, and spots and vittate markings on the elytra piceous, prothorax reddish brown.

Head with the interocular space scarcely half the width of the head, tubercles rather indistinctly marked, a median pit above them, carina indistinct, the lower front rather bulging, occiput to antennal sockets piceous, lower front pale yellow, labrum dark. Antennae brownish deepening to nearly piceous in joints six to eight, the three apical joints pale. Prothorax almost as long as wide with slightly curved sides, the usual transverse sulcus, very shiny, nearly impunctate, deep reddish brown. Scutellum dark brown. Elytra alutaceous but shiny, wider after the middle, finely and moderately densely punctate, not costate, pale yellow with a piceous spot on the humeri, extending along side to the middle, also a dark sutural vitta from base nearly to the middle, and two spots on each elytron below the middle, near apex, one along the side, the smaller one in the middle. Body beneath and legs pale with the breast dark, the sides of prosternum reddish brown as on pronotum. Length 6 mm.; width 3 mm.

Type, male, USNM 66841, from Loma Alta, Bolivia, collected by G. Pinckert, April 22, 1957.

Remarks: The markings are much like those of *N. comma* Bechyne but the prothorax is reddish brown, the antennae bicolored, and the elytra not at all costate.

***Neobrotica rendalli*, new species**

FIGURE 48

About 6 mm. in length, oblong oval, shining, the elytra densely and tending to be geminately striate punctate, with faint ridges or costae between, pale yellowish, the head piceous on the occiput, the

mouthparts, intermediate antennal joints and elytral markings piceous, a long vitta extending from the humerus along the side but not covering the margin, a dark area about and below the scutellum, and a very small median spot near the apex; body beneath and legs pale except for the dark breast.

Head with the interocular space a little more than half width of head, a median depression over the frontal tubercles, occiput shining, very finely punctate, a narrow carina running down the lower front, occiput of head to the antennal sockets and around the eyes piceous, lower front pale, mouthparts dark. Antennae with the intermediate joints dark. Prothorax not twice as wide as long with slightly curved sides and a transverse sulcus, shining, finely punctate, entirely pale. Scutellum pale. Elytra faintly costate with geminate striate punctation in the intervals, shining, pale yellow with piceous or deep brown markings, a vitta extending from the humerus along the side to the apical curve of irregular outline, suggesting the coalescence of three spots, and a broad dark area about the scutellum and a little way down the suture, also a small median spot near the apex of each elytron. Body beneath and legs pale with the breast dark. Length 6.2 mm.; width 3 mm.

Type, female, MCZ 30670, from Caparo Valley, Port-of-Spain, Trinidad, collected by Dr. Rendall, January 1897.

Remarks: Only one specimen, a female, is known. The elytra are a pale lemon color, possibly faded from a green. The unusual irregular lateral vitta on the elytra is distinctive of this species. Bowditch had attached the manuscript name *Rendalli* to it, after its collector.

***Neobrotica stalagma*, new species**

FIGURE 55

About 7 mm. in length, elongate oblong oval, shining although alutaceous, elytra feebly costate on sides and with punctures tending to be striate, yellow brown, the occiput of head piceous, the antennae with the intermediate joints dark and the elytra with a sutural dark vitta extending below the middle and a long dark humeral area uniting with a short median vitta and a shorter apical vitta on each elytron, breast dark, legs pale.

Head with the interocular space approximately half width of head, frontal tubercles swollen and a median depression above, the carina down the lower front not very distinct, but rather flat and punctate, upper half of head piceous, lower front pale, mouthparts dark. Antennae pale with brownish intermediate joints. Prothorax wider than long with curved sides and a transverse depression, alutaceous, very finely and indistinctly punctate, entirely pale yellow brown. Scutellum tan colored. Elytra with feeble costae along the sides,

distinctly alutaceous, finely and rather densely punctate, the punctures having a tendency to be geminate striate; pale yellow brown with a dark brown or piceous moderately wide humeral vitta curving inwards and connecting with a median spot or vitta, which extends down as far as the sutural vitta, another short vittate mark on the side at apical curve on each elytron. Body beneath pale with the breast dark, legs entirely pale. Length 7 mm.; width 3.5 mm.

Type, female, MCZ 30667, from Cali, Colombia, collected by Rosenberg, September–December 1894.

Remarks: There is one other specimen from Muso, Colombia, which may be a less heavily marked specimen of the same species. In this the median line does not connect with the humeral vitta. It is also a female.

***Neobrotica atrilineata*, new name**

FIGURE 57

Neobrotica lineigera Bechyne, Ent. Arb. Mus. G. Frey, vol. 7, no. 1, p. 318, 1956.

Between 5 and 6 mm. in length, oblong oval, faintly shining, alutaceous, the elytra finely punctate and with traces of costae along the sides, pale yellow brown with piceous occiput and narrow piceous elytral vittae, one extending from the humerus along the side to apical curve, a shorter one on the disc not reaching the base, and a short sutural one from about the scutellum down a little way on the suture.

Head with the interocular space less than half width of head, frontal tubercles somewhat swollen, a shallow median depression above and a narrow carina down the lower front, surface of occiput alutaceous and finely punctate; upper half of head often to the antennal sockets deep brown to piceous, lower front pale, mouthparts usually dark. Antennae usually entirely pale, but in one specimen joints five to eight deeper brown. Prothorax nearly as long as wide with slightly curved sides and a transverse sulcus; surface alutaceous and indistinctly and faintly punctate, pale. Scutellum brown. Elytra with traces of lateral costae, alutaceous and finely punctate, pale yellow brown, each elytron with a piceous vitta extending from the humerus to the apical curve, not reaching the apex, and a shorter median vitta not reaching the base on the disc, and a very short sutural vitta extending from around the scutellum a little way down the suture. Body beneath pale with the breast shining piceous, legs entirely pale, a spine on the middle and hind tibiae, first tarsal joint of the male enlarged. Length 5.3–6.3 mm.; width 2.8–3.1 mm.

Type, male, in G. Frey Museum, Tutzing, near Munich, Germany, from Santa Cruz, Bolivia.

Other localities: Cochabamba, Bolivia, collected by Germain.

Remarks: In 1887 Jacoby described a *Neobrotica linigera* from Panama, a quite different species from the one Bechyne described from Bolivia as *N. lineigera* in 1956. Also different from either is a species that Bechyne described in 1958 as *N. lineigera* from Brazil. The name *lineigera* is essentially the same as *linigera*, and according to rules of zoological nomenclature, article 58, no. 2, it should not stand as distinct. Bowditch had attached the manuscript name *atrilineata* to this species in a series in his collection from Cochabamba. It differs from *N. oberthüri* in having pale legs as well as a narrower prothorax. There are also traces of elytral costae in this species which are not present in *N. oberthüri*.

***Neobrotica flavolimbata*, new species**

FIGURE 62

About 7 mm. in length, elongate oblong oval, dull, alutaceous, the elytra strongly punctate with a tendency to being striate, yellow brown, the elytra mostly piceous with a narrow pale fascia below the middle, the margin and apex pale; legs, antennae and the body beneath entirely pale.

Head with the interocular space approximately half the width of head, a median depression above the rather poorly defined frontal tubercles, occiput finely punctate, a narrow carina down the front, on either side of which the surface is wrinkled, pale yellow brown with the labrum piceous. Antennae pale except for the dark brown tip of the apical joint. Prothorax with slightly rounded sides and a transverse shallow groove, finely punctate, entirely pale yellow brown. Scutellum pale. Elytra widened below the middle, alutaceous, not shiny, punctation strong and tending to be striate, with faint traces of costae, a few scattered hairs along the sides; a broad piceous basal and an apical fascia separated narrowly by a pale fascia below the middle, the margins and apex pale. Body beneath and legs entirely pale. Anterior coxal cavities open, claws appendiculate, a spine at the end of middle and hind tibiae. Length 7.4 mm.; width 3.7 mm.

Type, female, BMNH, Baly collection, from Merida (no label for country).

Remarks: The unusual elytral coloring of this species differentiates it from any of the others without strong elytral costae.

***Neobrotica hepatica* Bechyne**

FIGURE 51

Neobrotica hepatica Bechyne, Ent. Arb. Mus. G. Frey, vol. 9, no. 2, p. 597, 1958.

Between 6 and 7 mm. in length, oblong oval, somewhat shiny, faintly alutaceous, the elytra distinctly punctate, pale yellow with a reddish brown occiput and two broad reddish brown elytral fasciae interrupted

at the suture and each with a median pale spot, a narrow pale yellow fascia between them; body beneath reddish brown with deeper brown to piceous shadings in the middle of the abdomen and breast, femora deep brown to piceous.

Head with interocular space fully half width of head, smoothly rounded over occiput, shining, finely punctate, a median depression above the frontal tubercles, a narrow carina down lower front; upper part of head tan colored, lower half pale yellow; mouthparts tipped with brown. Antennae entirely pale. Prothorax much wider than long but not twice as wide, and with curved sides, a shallow transverse sulcus, in some specimens only an oblique depression on either side; very indistinctly punctate, pale yellow sometimes with a faint brown spot in the middle at base. Scutellum tan colored. Elytra pale with a broad reddish brown basal and an apical fascia having pale median spot on each elytron, the first fascia not reaching the base and the apical one not reaching the apex, leaving the margins and suture pale and a narrow pale fascia between the tan colored ones below the middle. Body beneath tan colored with darker, often piceous, shadings on the side of the breast and middle of the abdomen and metasternum. Femora deep brown or piceous and usually pale at the apex; tibiae and tarsi pale, middle and hind tibiae with spine, front coxal cavities open, claws appendiculate. Length 5.7–7.2 mm.; width 3.1–3.6 mm.

Type, female; one paratype; both in G. Frey Museum, Tutzing, near Munich, Germany, from Rio Huallaga, Tingo Maria, Peru.

Other localities: A large series of this species in the California Academy of Sciences, was taken by E. I. Schlinger and E. S. Ross in the Monzon Valley, Tingo Maria, Peru, Sept. 21, 1954, and another series in the U.S. National Museum was also taken at Tingo Maria by J. Dieguez in October 1949, on *Erythrina*.

Remarks: The unusual color pattern of this species easily distinguishes it from other species of *Neobrotica*.

***Neobrotica rogaguaensis*, new species**

FIGURE 52

About 6 mm. in length, elongate oblong oval, shining, densely and not coarsely punctate, the elytra with faint traces of costae; pale yellow with pale reddish brown markings on the occiput, on the intermediate joints of the antennae, tibiae and tarsi and the three broad elytral fasciae interrupted at the suture, the apical one with an elongate pale spot on each elytron.

Head with the interocular space half width of head, occiput although alutaceous finely punctate about the median depression over the frontal tubercles, carina very short ending in a depression between the rather bulging sides of the lower front, occiput and labrum reddish

brown, lower front pale yellow. Antennae brownish, shading to deep brown in the intermediate joints, terminal three joints pale yellow with the tip dark. Prothorax somewhat rectangular but not twice as wide as long with slightly rounded sides, the transverse sulcus well marked, surface shiny, very finely punctate. Scutellum brown. Elytra alutaceous, feebly shining, rather densely and distinctly punctate, faintly costate; pale yellow with a basal, median and apical fascia with an elongate pale spot, possibly in some specimens dividing this apical fascia into two. Body beneath and femora pale, tibiae and tarsi more or less brownish piceous, anterior coxal cavities open, the claws appendiculate. Length 5.8 mm.; width 3 mm.

Type, male, USNM 66846, from Rosario, Lake Rogagua, Bolivia, collected by W. M. Mann, Oct. 28–Nov. 9, 1921.

Remarks: The pale reddish brown markings and rather unusual elytral pattern sufficiently differentiate this species. In coloring it is closest to *N. hepatica* Bechyne, having similar reddish brown elytral markings.

Neobrotica inconstans Jacoby

FIGURE 61

Neobrotica inconstans Jacoby, Proc. Zool. Soc. London, p. 285, 1889.

About 6 mm. in length, elongate oblong oval, shining, faintly alutaceous, head, breast, intermediate joints of antennae, tibiae and tarsi piceous; base of head, thorax and rest of beetle pale yellowish brown, except in one specimen, which has a dark spot on the humerus; the elytra not at all costate but with bare lines instead, the intervals being geminate striate.

Head with interocular space about half width of head, shining piceous except at the base which is pale, a median depression above the rather indistinctly marked frontal tubercles, carina down front not distinguishable from the slightly swollen lower front. Antennae with the three basal joints and three apical ones pale, intervening ones piceous. Prothorax almost twice as broad as long with rounded sides and transverse sulcus, finely punctate, shining, pale yellow brown. Scutellum pale. Elytra widened in apical half, a short shallow intrahumeral sulcus, punctation in double rows between bare lines, not at all costate, surface faintly alutaceous but shiny, pale yellow brown; one elytron paler near the suture than on the sides, the other uniformly yellow brown. Jacoby writes that one specimen has a humeral dark spot. Body beneath pale with the breast piceous, femora pale, tibiae and tarsi dark. Length 6 mm.

Type, whereabouts unknown; "variety," female, in MCZ, from Tovar Colonia, Prov. Guzman, Blanco Mts., 1900 m., Venezuela, collected by E. Simon in 1888.

Remarks: Only one specimen of this species has been examined, the "variety" of Jacoby's description, which is in the Museum of Comparative Zoology. The species was described from a collection of beetles by E. Simon, made in Venezuela in 1888, and it is possible that the typical form was returned to the collector. It is not in the British Museum (Natural History). In the typical form Jacoby describes the elytral shoulders as having a "short narrow elongate and angular black mark, the lower angle of which turns inwards and a round piceous obscure spot below." He describes the variety as being immaculate, the specimen as having the left elytron pale green and the right one fulvous. In this specimen at present the green has entirely disappeared, leaving the elytron mostly pale yellow but not so deep in color as the right elytron, which is yellow brown. The distinctive thing about the species is the lack of costation and the presence of bare longitudinal lines on the elytra with the intervals geminate striate punctate.

***Neobrotica germaini*, new species**

FIGURE 46

About 5.5 mm. in length, elongate oblong oval, feebly shining and somewhat alutaceous, the elytra distinctly and rather densely punctate, pale reddish brown with a dark piceous occiput on head and dark markings having a faint violaceous tint on the elytra, these consisting of a sutural vitta not reaching the middle and a dark lateral mark from the humerus down the side of the same length as the sutural vitta, which curves at the end across the elytron but does not reach the suture, and near the apex on each elytron a thick lunate mark opening towards the suture; breast dark, rest of undersurface and legs pale.

Head with interocular space approximately half width of head, a small median depression over the frontal tubercles, a carina down lower front which is reddish brown, the occiput being piceous. Antennae with third joint shorter than fourth, joints five to eight deeper brown, apical two joints pale yellow with the tip dark. Prothorax with rounded sides, shining, smooth, the transverse sulcus represented by an oblique depression on each side, entirely reddish brown. Scutellum piceous. Elytra faintly costate, distinctly and confusedly punctate, reddish brown with dark markings having a faint violaceous tint and as described above. Body beneath and legs reddish brown except the breast which is shining piceous. Anterior coxal cavities open, claws appendiculate. Length 5.5 mm.; width 2.5 mm.

Type, female, Bowditch collection, MCZ 30816, from Cochabamba, Bolivia, collected by Germain.

Remarks: Bowditch has attached the manuscript name *N. germari* to this distinctive little species, meaning, I believe, to name it after its collector. The label reads simply "Germ.," but I believe that instead of the German Germar who died in 1853, this abbreviation is for Germain (1827–1913), the Chilean entomologist who collected in the Andes and wrote many papers on the insects of Chile.

This species is more costate and more stongly punctate than *N. ruficollis*, and the third joint is shorter than the fourth antennal joint, which joints in *ruficollis* are subequal.

Neobrotica erythrinae Bechyne

FIGURE 43

Neobrotica erythrinae Bechyne, Ent. Arb. Mus. G. Frey, vol. 9, no. 2, p. 598, 1958.

Between 5 and 7.5 mm. in length, elongate oblong oval, somewhat shiny, although faintly alutaceous, the elytra densely and finely punctate, pale yellow with the upper part of the head piceous black and the breast black; the elytra varying from having heavy piceous markings over the base, middle and apex to being pale with only traces of these markings at the side, suture and apex; tibiae with a dark streak.

Head with the interocular space approximately half width of head, occiput smoothly rounded, alutaceous, very finely punctate, the frontal tubercles not well marked but somewhat swollen and above them a median depression; lower front with a very narrow carina, upper part of the head and about the eyes piceous, lower front sometimes entirely pale but usually with a median darkening and dark mouthparts. Antennae with the intermediate joints brownish, tip of terminal joint dark. Prothorax a little wider than long, with somewhat curved sides and a rather shallow transverse sulcus, often marked only by an oblique depression on either side, shining, impunctate, pale yellow. Scutellum piceous. Elytra very finely punctate, alutaceous, pale yellow with variable dark piceous markings; in the more darkly marked specimens on each elytron a large dark basal spot often connecting along the side with a median dark fascia that does not reach the suture, or this may be entirely lacking; at the apex another broad band, sometimes broken up into a semicircular dark marking near the apex, the suture dark about the scutellum, in the paler specimens only remnants of these fasciae marked by spots on the humerus, along the side, and at apex. Body beneath pale with the breast dark, legs pale, the tibiae with a darker streak on the outside, the abdomen dorsally somewhat darker. Length 6.5–7.5 mm.; width 2.5–3 mm.

Type and paratype in the George Frey Museum, Tutzing, near Munich, from Tingo Maria, Rio Huallaga, 700 m., collected by

Weyrauch, July 1947, and by J. Diaguez at the same locality in October 1949; both collections taken on *Erythrina*.

Remarks: In a large series of this species in the U.S. National Museum the markings are very variable, scarcely any two specimens being exactly alike. I cannot detect any sexual dimorphism in the color pattern as suggested by Bechyne.

***Neobrotica regularis*, new species**

FIGURE 42

About 5 mm. in length, narrowly oblong oval, faintly shining, alutaceous, the elytra finely and densely punctate, pale yellow brown, the head over the occiput down to the frontal tubercles piceous, the elytra with piceous markings across the base and down the side at the middle united with a spot and sometimes before the apex united with a large spot, the breast dark, legs and antennae pale.

Head with the interocular space less than half width of head, frontal tubercles swollen, a median depression above them and a narrow carina down the lower front; occiput alutaceous, very finely punctate, piceous with the lower front pale. Antennae entirely pale. Prothorax a little wider than long with nearly straight sides and a transverse sulcus across disc; surface faintly alutaceous and shining, entirely pale. Scutellum tan colored. Elytra not at all costate with a short intrahumeral sulcus, strongly alutaceous and densely and finely punctate; on each elytron a broad piceous band across the base extending about the scutellum and a little way down the suture, and from the humerus down the side, uniting with another large spot before the middle and sometimes with another before the apex, or this may not be united. Body beneath pale with the breast dark, the legs entirely pale; middle and hind tibiae with spine. Length 5.3 mm.; width 2.8 mm.

Type, male, MCZ 30669; one paratype, BMNH; both from Venezuela and labelled "Laferté collection Venezuela."

Remarks: Bowditch has given this the manuscript name *N. regularis*. It is closely related to *N. erythrinae* Bechyne from Tingo Maria, Peru, but the elytral markings are slightly different and, unlike *N. erythrinae*, it has pale legs and pale antennae.

***Neobrotica bowditchi* Bechyne**

FIGURE 60

Neobrotica inconspicua Bowditch, Canadian Ent., vol. 44, p. 15, 1912. [Not *N. inconspicua* Jacoby.]

Neobrotica bowditchi Bechyne, Ent. Arb. Mus. G. Frey, vol. 9, no. 2, p. 596, 1958.

From 6 to 7 mm. in length, elongate oblong oval, not very shiny, alutaceous, the elytra densely punctate, pale yellowish brown, one

specimen with a reddish brown humeral spot, and in the same specimen the head on top deep brown. Antennae pale yellowish brown.

Head with interocular space less than half width of head, occiput alutaceous, finely punctate, the frontal tubercles a little swollen with a median depression above and a narrow carina down lower front, in one specimen the occiput brown, in the rest entirely pale. Antennae moderately long, yellowish brown. Prothorax somewhat wider than long with slightly curved sides and a transverse sulcus, surface alutaceous, distinctly punctate. Scutellum pale. Elytra without signs of costae, densely, shallowly and rather coarsely punctate, the punctures tending to be in rows, surface dull alutaceous, pale yellowish brown, in one specimen a reddish brown humeral spot. Body beneath pale with the breast in some specimens a little deeper in shading, legs entirely pale, front tibiae in the male enlarged, a spine on the middle and hind tibiae. Length 6–7.3 mm.; width 3.4–4 mm.

Type, male; one paratype; both in MCZ, from Callanga, Peru.

Other localities. Five specimens in the Museum of Comparative Zoology all females, from Cochabamba, Bolivia, collected by Germain; one specimen in the U.S. National Museum, one specimen in the Frey Museum from Peru.

Remarks: Jacoby has already described a *Neobrotica inconspicua* from Mexico which is also an entirely pale species except for the antennae, but with elytral costae.

Neobrotica octosignata, new species

FIGURE 64

Between 6 and 8.5 mm. in length, elongate oblong oval, not very shiny, alutaceous, elytra not at all costate, coarsely and confusedly punctate, pale yellow brown; the elytra with reddish brown or piceous spots, one on the humerus, one large one below the scutellum near the suture, another near apex and suture, and one at the apical curve on the side of each elytron.

Head with interocular space about half width of head, a median depression over frontal tubercles, occiput alutaceous and finely punctate, a rather poorly defined carina down the lower front, lower front punctate on the sides, head entirely pale. Antennae pale with the intermediate joints a little deeper in color. Prothorax wider than long with slightly curved sides and a transverse sulcus; alutaceous and finely punctate, usually entirely pale but one specimen with a piceous spot on each side anteriorly, no trace of this spotting in the other four specimens. Scutellum pale. Elytra without costae, alutaceous, not shining, densely and rather coarsely punctate, the punctures tending to be striate; pale yellow brown with reddish brown to piceous spots, one covering the humerus, another large one a little below the scutellum

and near the suture, a third in line with the second near the apex, and a fourth at the apical curve on the side on each elytron. Body beneath and legs entirely pale, spines on all the tibiae. Length 6–8.5 mm.; width 3.1–4.2 mm.

Type, female, MCZ 30672, from Marcapata, Peru; one specimen labelled "Peru," collected by M. Kirsch, 1st Jacoby collection; five specimens, BMNH, three labelled "Peru," collected by M. Kirsch, and one without a label.

Remarks: The specimens in the British Museum have the name "*Diabrotica 8-punctata* Jacoby i.l." (in litt.) and those in the Bowditch collection "*Neobrotica 8-signata*," also a manuscript name. This species resembles one from Costa Rica but lacks the small spot below the humerus found in that species and the antennae are shorter. A specimen of this species was collected at Tingo Maria, Dept. Huanuco, Peru, 670 m., by G. H. Dieke Aug. 16–25, 1951.

***Neobrotica grandis*, new species**

FIGURE 66

Approximately 8 mm. in length, elongate oblong oval, dull alutaceous, not at all shiny, the elytra very faintly costate with dense, not coarse punctation, pale yellow with darker mouthparts, the elytra with a deep brown almost piceous spot on the humerus, another before the middle and one after the middle and another at the apical curve, a dark edging about the scutellum on each elytron.

Head with interocular space half its width, a depression over the frontal tubercles and finely punctate about this depression, the occiput alutaceous, a narrow carina down the lower front with coarse punctures on either side, entirely pale except the brown mouthparts. Antennae pale with a little deeper coloring in the intermediate joints. Prothorax a little wider than long with slightly curved sides and a transverse sulcus, surface dull, alutaceous with fine punctures. Scutellum pale. Elytra faintly costate with the intervals irregularly geminate punctate, the punctures shallow and dense, surface dull, alutaceous, not at all shiny, pale yellow with small deep reddish brown spots, one on the humerus, one before and one after the middle, and one on the side at apical curve, the scutellum edged with dark. Body beneath and legs entirely pale, spines on all the tibiae. Length 8 mm.; width 3.7 mm.

Type, female, MCZ 30673, from Cauca, Colombia.

Remarks: The dull alutaceous surface together with the position of the elytral spots separate *N. grandis* from the other large spotted species. It is larger as well as paler than *N. colombiensis*, the under surface being entirely pale, and there are traces of costae which are

lacking in *colombiensis* and the dull alutaceous surface is unlike that species. Bowditch has attached the manuscript name *grandis* to it.

Neobrotica quadrimaculata, new species

FIGURE 65

About 7 mm. in length, elongate oblong oval, somewhat shiny, alutaceous, elytra densely and strongly punctate, the prothorax with a shallow transverse sulcus, pale yellow brown, the occiput of head piceous, breast dark, elytra with a small dark spot on the humerus and another small one before the middle of each elytron.

Head with interocular space half width of head, frontal tubercles swollen, a depression above, carina short, lost in the bulging lower front, head piceous over occiput, from frontal tubercles down yellowish brown. Antennae with the terminal joint missing, brownish with joints 9 and 10 pale yellow. Prothorax with sides slightly curved, a very shallow transverse sulcus, shiny, nearly impunctate, yellowish brown. Scutellum tan colored. Elytra wider towards apex, distinctly punctate, alutaceous, faintly shiny, no signs of costae, markings as above. Body beneath pale yellowish brown with the breast dark, legs entirely pale; middle and hind tibiae with a spine, anterior coxal cavities open, claws appendiculate. Length 7 mm.; width 3 mm.

Type, female, BMNH, from Mucutuy, La Veganilla, 5000 ft., E. Merida, Venezuela, collected by J. Hanbury Tracey, Oct. 21, 1938.

Remarks: This is another of the large pale spotted species. It differs from the others in having only four elytral spots with the occiput of the head dark.

Neobrotica ludicra Bechyne

FIGURE 67

Neobrotica ludicra Bechyne, Ent. Arb. Mus. G. Frey, vol. 9, no. 2, p. 599, 1958.

Approximately 8 mm. in length, elongate oblong oval, the elytra strongly and densely punctate, pale yellow with the head dark and dark markings along the base of the elytra extending down the side and down the suture about a quarter the length of the elytra, also a large dark spot on each elytron on the side near the apex.

Head with the interocular space more than half the width of the head, tubercles somewhat swollen with a shallow median depression above, occiput smooth, finely punctate, carina very short and broad, cheeks bulging. Antennae long and slender, the basal three and apical three joints pale, intermediate ones deeper brown; third joint not much longer than second and fourth joint nearly three times as long as second. Prothorax considerably wider than long, with slightly curved sides; the transverse sulcus not deep, very finely punctate,

shining, pale yellow. Scutellum pale. Elytra in type specimen shrivelled, probably wider in apical half, shiny, densely and strongly punctate; a piceous basal marking covering the entire base and running down side from the humerus and also extending down the suture about a quarter of the length of the elytra, a large piceous spot on the side near the apex of each elytron, not joined at the suture. Body beneath pale, legs entirely pale. Anterior coxal cavities open, claws appendiculate. Length 8 mm.

Type, female, in G. Frey Museum, Tutzing, near Munich, from Coroico, Bolivia.

Remarks: It is very doubtful whether this species should be included in the genus *Neobrotica*. The antennae are not typical of *Neobrotica*, the third joint being about the length of the second, and the fourth and fifth joints nearly three times as long as the third. The head is also different, having only a very short carina. Dr. Gerhard Scherer has made a drawing of the head for this paper. Unfortunately the only specimen known is a female. In this group with the short third antennal joint, the male usually has other characteristics, such as excised middle tibiae. Until a male is found, it is impossible to be certain of the genus in which this species belongs.

Neobrotica anisocincta Bechyne

FIGURE 68

Neobrotica anisocincta Bechyne, Ent. Arb. Mus. G. Frey, vol. 9, no. 2, pp 599–600, 1958.

About 5 mm. in length, elongate oblong oval, shining, the elytra coarsely and rugosely punctate, pale yellow with a dark head, dark basal fascia and another narrower one near the apex of elytra, dark breast and dark intermediate joints of the antennae.

Head with interocular space half width of head, a depression above frontal tubercles, occiput shining with a few punctures near base, no carina down lower front, the lower front somewhat bulging; entirely dark. Antennae with the basal and three apical joints pale, intermediate ones dark, the third antennal joint only half as long as the fourth. Prothorax with a transverse sulcus, the sides slightly rounded, entirely pale. Scutellum pale. Elytra widened behind, very rugosely punctate, shining, pale with a wide dark basal fascia extending one-third the length of the elytra, and another near the apex not so wide. Body beneath pale with the breast dark, legs entirely pale. Length 5.3 mm.

Type, female, in G. Frey Museum, Tutzing, near Munich, Germany, from Callanga, Peru.

Remarks: Unfortunately only one specimen, a female, is known, and this one is an old dirty specimen. This is probably not a species of

Neobrotica. The third antennal joint is only half as long as the fourth. The head lacks a carina. Dr. Gerhard Scherer has made a detailed drawing of the front of the head. Until a male is found I cannot place this in a genus. The claws while not bifid have a longer basal tooth than is usual in the *Neobrotica*.

Hystiopsis, new genus

Elongate oblong oval, the head in both sexes with the lower front depressed below the antennal sockets, the antennae alike in both sexes, being filiform with the third and fourth joints subequal. Pronotum with a well defined transverse sulcus. Elytra strongly costate with the intervals more or less coarsely and usually geminate striately punctate. Anterior coxal cavities open, tibiae with a spine at the end, anterior tibiae in the male usually enlarged and the first tarsal joint in the male usually thickened, first tarsal joint of hind legs longer than the others together, claws appendiculate.

Type species: *Crioceris marginalis* Fabricius.

Remarks: The genus is erected for a group of South American beetles that are closely related to *Neobrotica*, *Eccoptopsis*, and *Eucerotoma*. They have the strong elytral costae of *Eucerotoma*, but lack the sexual differences found in the excavated face and antennal joints of the male in both *Eucerotoma* and *Eccoptopsis*. They are closely related to *Neobrotica* but differ in the depressed lower front of the face. This depressed lower front is common to both sexes and not so definitely excavated as in *Eucerotoma* and *Eccoptopsis*.

The name *Hystiopsis* is derived from the Greek ὑστίος, meaning "bent back," and ὄψις, meaning "face."

Key to Species of *Hystiopsis*

1. Head pale on occiput 2
   Head dark on occiput 3
2. Elytra with a dark lateral vitta from humerus to near apex and also a dark sutural vitta . . . . . **marginalis** (Fabricius) (p. 325)
   Elytra with a dark area about scutellum and three dark spots on each elytron . . . . . **exarata**, new species (p. 338)
3. Elytra dark with pale spots or fascia 4
   Elytra pale with dark spots, fasciae or vitta 8
4. Prothorax pale with a dark median vitta . . **irritans**, new species (p. 334)
   Prothorax entirely pale 5
5. Each elytron with three pale spots, the apical one being open at apex . . 6
   Each elytron with less than three spots 7
6. Apical spot common to both elytra . . . . . **grossa**, new species (p. 337)
   Apical spot not common to both elytra . . **maculata**, new species (p. 334)
7. Elytra with a narrow pale fascia below middle and no spots. **zonata**, new species (p. 333)

Elytra with a pale fascia varying in width and on each elytron a basal spot also varying in size . . . . . **bella,** new species (p. 332)

8. Legs entirely dark . . . . . **nigriventris,** new species (p. 326)
Legs not entirely dark 9

9. Elytra with a lateral vitta from humerus to apical curve 10
Elytra without a long lateral vitta 12

10. Elytra with a median apical spot or short vitta . **peruensis,** new species (p. 328)
Elytra without an apical spot or vitta 11

11. Large (9 mm.), Colombia . . . . . **maxima,** new species (p. 335)
Small (6 mm.), Trinidad . . . . . **bryanti,** new species (p. 331)

12. Elytra pale with a dark spot on humerus and a dark apical area enclosing a pale spot . . . . . **phaica,** new species (p. 336)
Elytra not with a dark apical area enclosing a pale spot 13

13. Elytra with a wide basal fascia . . . . . **flavipes,** new species (p. 329)
Elytra without a wide basal fascia 14

14. Elytra with a wide apical fascia . . . . . **terminalis,** new species (p. 328)
Elytra without a wide apical fascia 15

15. Large (8 mm.) . . . . . **megala,** new species (p. 336)
Smaller (5–7 mm.) 16

16. Legs with apex of hind femora and tibiae and tarsi more or less dark. **mapirii,** new species (p. 331)
Legs entirely pale 17

17. Elytra with a dark lateral vitta extending below middle and a sutural vitta at apex and large spot on side . . . . . **beniensis,** new species (p. 327)
Elytra with a dark spot on humerus and a dark area about scutellum and a short vitta at side and spot in middle at apex . . **mansei,** new species (p. 330)

Hystiopsis marginalis (Fabricius)

FIGURE 70

Crioceris marginalis Fabricius, Systema eleutheratorum, pt. 1, p. 454, 1801.

Diabrotica marginalis (Fabricius).—Gemminger and Harold, Catalogus coleopterorum, vol. 12, p. 3563, 1876.—Weise, *in* Schenkling, Coleopterorum catalogus, pt. 78, p. 38, 1924.

About 6.5 mm. in length, elongate oblong oval, dull alutaceous, each elytron with eight strong costae, the intervals geminate punctate; pale yellowish brown sometimes reddish brown, with deeper brown elytral markings in the shape of a wide vitta from the humerus nearly to the apex along the side, a narrow sutural vitta ending before the apex, a round basal spot along the side of the scutellum and a median spot near the apex of each elytron.

Head with interocular space approximately half width of head, occiput alutaceous and finely punctate, frontal tubercles not well marked, a little swollen and a median depression above them, an indistinct carina running down the lower front from between antennal sockets, lower front depressed; entirely pale reddish brown. Antennae long and slender, brownish with the three terminal joints paler. Prothorax a little wider than long with nearly straight sides, a transverse sulcus; dull alutaceous, finely punctate, pale reddish brown. Scutellum pale. Elytra with eight fairly strong costae on each elytron, the intervals

being for the most part geminate striate punctate; explanate margin noticeably wide, surface dull and alutaceous; pale yellowish or reddish brown with dark brown or piceous markings, a broad lateral vitta extending from over humerus along the side nearly to the apex, a narrow sutural vitta which widens at apex, a roundish area on each side of the scutellum, another median roundish area near the apex. Body beneath entirely pale, legs with tibiae usually deeper brown on outside edge; in the male the front tibiae and first tarsal joint enlarged. Length 6.2–6.5 mm.; width 3 mm.

Type in Fabricius collection, Copenhagen, Denmark, "Habitat in America meridionali, D. Smidt, Mus. D. Lund."

Other localities: Two specimens, John Wilcox collection, from Caura River, Suapure, Venezuela, collected April 7, 1899, by E. A. Klages; two females, Bowditch collection, MCZ, without labels; one female, BMNH, from Surinam (Dutch Guiana).

Remarks: In markings this species closely resembles *H. peruensis* but the elytra are more strongly costate and the head is pale instead of being piceous.

***Hystiopsis nigriventris*, new species**

FIGURE 79

About 7 mm. in length, oblong oval, faintly shining, alutaceous, the elytra distinctly costate with geminate punctation in the intervals; head, breast and abdomen, tibiae and tarsi, and part of femora dark; prothorax and elytra pale yellow, the latter with a long humeral dark vitta extending almost to the middle of the elytra, the area about the scutellum also piceous, the suture widely piceous in the apical half joining with a lateral dark vitta extending from below the middle to the apex, leaving the margin pale.

Head with interocular space half width of head, occiput finely punctate, alutaceous but shiny, frontal tubercles swollen and a median depression above them, lower front depressed, a fine elevated line down from between the antennal sockets; head entirely dark except the neck, antennae dark with the last three joints pale, the tip being dark. Prothorax considerably wider than long with nearly straight sides and a transverse depression, alutaceous, finely punctate, entirely pale yellow. Scutellum piceous. Elytra with 7 or 8 more or less distinct costae, the intervals being geminate punctate, alutaceous but feebly shining, pale yellow, a piceous marking extending from humerus along side nearly to the middle, and another along side from below the middle to apex and uniting there with a broad sutural vitta, the margin pale; another piceous marking extending from about scutellum down the

suture nearly to the middle, the intervals between that and the apical sutural dark area being very narrowly piceous. Body beneath with the breast piceous and abdomen dark brown, femora dark above and at apex, tibiae and tarsi dark. Length 6.8 mm.; width 3.5 mm..

Type, female, CAS, from the valley of the Rio Monzon, Tingo, Maria, Peru, collected by E. I. Schlinger and E. S. Ross, Dec. 2, 1954.

Remarks: This is an unusually dark colored species, but very similar to *H. peruensis* with slightly different markings.

***Hystiopsis beniensis*, new species**

FIGURE 86

Between 5.5 and 7.5 mm. in length, oblong oval, somewhat shiny although alutaceous, the elytra strongly costate with the intervals geminate striate punctate; pale yellow brown, the head on top and sometimes below shining piceous, the elytra with a piceous lateral vitta extending part way down the side to below the middle, a short sutural vitta not reaching the middle, a large spot at the apical curve on each elytron and a short apical sutural vitta; breast piceous, legs pale.

Head with the interocular space about half its width, occiput polished, finely punctate, frontal tubercles somewhat swollen with a median depression above, lower front depressed; piceous, sometimes the lower front pale or in part pale. Antennae deep brown to piceous with the terminal three joints pale, tip of last joint dark. Prothorax a little wider than long, with slightly curved sides and a transverse depression, alutaceous and in places densely and finely punctate; pale yellow brown. Scutellum tending to be pale, sometimes dark brown. Each elytron with 7 or 8 costae, the intervals being geminate striate punctate, pale yellow brown with a wide piceous lateral vitta extending not quite to middle, and another shorter sutural one near the apex, and a large spot at apical curve. Body beneath pale with the breast shining piceous, legs pale. Length 5.7–7.5 mm.; width 3.2–3.7 mm.

Type, female, MCZ 30680; two paratypes, one USNM, one MCZ; all from Salinas, Beni River, collected by M. Stuart, July 1895. There are also five specimens, all females, from Cochabamba, Bolivia, collected by Germain; specimens from Siamas and Rurrenabaque, Rio Beni, Bolivia collected by W. M. Mann, October 1922, from Loma Alta, Bolivia, collected by Pinckert, May 21, 1957; Misiones Province, Argentina, Monros' collection, USNM.

Remarks: Bowditch has attached the manuscript name *beniensis* to this species. It is closely related to *H. marginalis* (Fabricius) and others with the front of the face depressed and the elytra strongly costate.

***Hystiopsis peruensis*, new species**

FIGURE 69

About 6.5 mm. in length, elongate oblong oval, shining although faintly alutaceous, the elytra distinctly costate with geminate striate punctation in the intervals between; pale yellow with the head dark brown to the pale mouthparts, elytra with a broad metallic blue vitta running from the humerus down the side, a short sutural vitta below the scutellum and a median elongate spot before the apex on each elytron.

Head with interocular space about half width of head, occiput polished, with a few fine punctures, frontal tubercles somewhat swollen and a shallow median depression above; lower front somewhat depressed, a faint trace of median carina from between the antennal sockets; head dark brown except for pale yellow mouthparts. Antennae brown with the three terminal joints paler. Prothorax somewhat wider than long with nearly straight sides and a transverse depression; surface shining although faintly alutaceous and with scattered punctures; entirely pale yellow. Scutellum pale. Elytra with seven or eight pronounced costae and in the intervals between these shallow and rather coarse geminate striate punctation, pale yellow with a broad metallic blue vitta covering the humerus and extending down the side to apical curve; another short sutural vitta running down a little way below the scutellum, and an elongate median spot near the apex. Body beneath and legs entirely pale. Length 6.5 mm.; width 3.5 mm.

Type, female, Bowditch collection, MCZ 30681, from "Peru."

Remarks: Bowditch has attached the manuscript name *peruensis* to this species. Only one specimen is known, but it is clearly closely related to *H. marginalis* (Fabricius) and others with the lower front of the face somewhat depressed and without distinct carina and with costate elytra.

***Hystiopsis terminalis*, new species**

FIGURE 71

About 6 mm. in length, elongate oblong oval, moderately shiny although alutaceous, the elytra strongly costate with the intervals geminate striate punctate, pale yellowish brown, the head with a dark occiput, the elytra with dark piceous vittae along the side and suture not reaching the middle, and a wide dark apical fascia, breast dark; head depressed in front in the male.

Head with the interocular space less than half width of head, eyes prominent, occiput shining piceous, finely punctate, a median depression over the poorly marked frontal tubercles and the lower front depressed with a ridge on either side below the antennal sockets,

carina only visible between the antennal sockets, lower front pale yellow. Antennae yellowish brown with joints five to eight a little deeper in color. Prothorax with slightly curved sides and a transverse sulcus, yellowish brown. Scutellum bicolored. Elytra wider towards the apex, strongly costate with the intervals geminate striate punctate, pale yellowish brown with a wide piceous vitta from the humerus down the side not reaching the middle, a common sutural vitta of about the same length, and a wide dark apical band, the apex pale. Body beneath and legs pale, the breast dark. Anterior tibiae and tarsi in male much swollen, middle and hind tibiae with a spine. Length 6 mm., width 3 mm.

Type, male, BMNH, Baly collection, from the upper Amazon.

Remarks: The elytral markings are slightly different from any other species of *Hystiopsis*.

***Hystiopsis flavipes*, new species**

FIGURE 73

Between 6.5 and 7.5 mm. in length, elongate oblong oval, somewhat shiny although alutaceous, the elytra strongly costate with the intervals between geminate striate punctate, pale yellow brown with a piceous head and broad piceous fascia across base of elytra and two large piceous spots at apex not quite meeting at the suture, other specimens less heavily marked; antennae with the intermediate joints darker.

Head with the interocular space fully half as wide as head, frontal tubercles not very well marked and a depression above; in the male no sign of a carina, the area below the antennal sockets depressed; in the female not quite so depressed with a fine line scarcely at all elevated marking the usual carina, below the depression the lower front a little bulging; occiput shiny and finely punctate, head shiny piceous down to the paler mouthparts. Antennae with the basal three and terminal four joints pale yellow brown, the middle joints deeper brown. Prothorax considerably wider than long with nearly straight sides and a transverse depression, strongly and moderately densely punctate, entirely pale. Scutellum pale. Elytra with seven or eight costae on each elytron, the intervals being more or less geminate striate punctate; surface faintly alutaceous, a broad piceous fascia in basal half not reaching the middle; in one specimen with a narrow pale median area near the base, and another fascia divided into two spots by the suture near the apex; in one specimen the basal fascia only a humeral and sutural elongate spot. Body beneath pale with the breast dark, legs pale, front tibiae and first tarsal joint of the male not enlarged, a spine at the apex of tibiae, claws appendiculate. Length 6.5–7.6 mm.; width 3.3–3.9 mm.

Type, male, John A. Wilcox collection, from Caura River, Suapure, Venezuela, collected by E. A. Klages, March 20 and April 14, 1899; paratype, female, USNM; one female specimen, MCZ, from Rio Madeira, Brazil, collected by Mann and Baker.

Remarks: In the more heavily marked specimens this species resembles *Neobrotica coeruleofasciata* Jacoby but that species is not so strongly costate and has metallic colored spots and is somewhat smaller. The head of *N. coeruleofasciata* has no such depression in the lower front as in this species.

***Hystiopsis mansei*, new species**

FIGURE 83

About 6.5 mm. in length, elongate oblong oval, shining, the elytra strongly costate, the intervals geminate punctate; pale yellow brown, the head piceous with paler mouthparts; the elytra with piceous or dark blue spots on humerus, about scutellum and along side at apical curve and another spot near the suture at apex, breast dark.

Head with interocular space about half width of head, occiput smooth, shiny, finely punctate, frontal tubercles not very distinct, but swollen, a median depression above, no carina down front, the lower front depressed, the head piceous except for the light brownish neck below and paler mouthparts. Antennae reddish brown with the three terminal joints paler, tip of last joint dark. Prothorax considerably wider than long with nearly straight sides and a transverse depression, a few fine punctures, otherwise smooth, shining, pale. Scutellum pale. Each elytron with 7 distinct costae, the intervals being geminate punctate; surface faintly alutaceous, shiny, pale yellow brown with a piceous spot on humerus, a piceous marking about scutellum, running down the suture a short way, an elongate piceous spot at the apical curve and another near the suture at apex of each elytron, these dark markings sometimes with a dark blue or violaceous lustre. Body beneath pale with the breast dark, legs pale. Length 6.5–7 mm.; width 3.5 mm.

Type, female, Bowditch collection, MCZ 30682, from Rio Manse, Amazon, collected by Staudinger, 1st Jacoby collection; one paratype, female, USNM, from same locality; four specimens, BMNH, two from the Amazon region, one from Rio Purus, collected Dec. 9, 1874, and one from Barreiras das Araras, Amazon, collected by R. Solimoes, Nov. 15, 1874; one specimen, John A. Wilcox collection, from Caura River, Suapure, Venezuela, collected by E. A. Klages, April 1899.

Remarks: Bowditch has attached the manuscript name of *mansei* to this species which is another of those with a depressed lower front of the face and strongly costate elytra. It is closely related to *H. marginalis* (Fabricius).

***Hystiopsis bryanti*, new species**

FIGURE 72

About 6 mm. in length, elongate oblong oval, shining, the elytra with many flat costae, the interstices being geminate striate punctate, yellow brown with the occiput of the head piceous, a brown lateral vitta interrupted before the apex on the elytra, and a brown area about scutellum.

Head with the interocular space half width of head, frontal tubercles swollen but not very definitely marked, a median depression above them, carina a thin line down front, lower front depressed, punctate, tan colored, the occiput and mouthparts piceous. Antennae brownish with the three basal and three apical joints paler. Prothorax almost rectangular, the sides slightly curved, a shallow transverse sulcus, shiny, impunctate, yellowish brown. Scutellum yellowish brown. Elytra shining and with many low costae, the intervals being irregularly and rather coarsely geminate-striately punctate, yellowish brown with deeper brown lateral markings and a narrow brown area surrounding the scutellum. Body beneath and legs pale, the breast piceous, middle and hind tibiae with a spine. Length 6 mm.; width 3 mm.

Type, female, BMNH, from Trinidad, collected by G. E. Bryant, March 1903.

Remarks: Only one specimen, a female, is known. The coloration is unlike any of the other species. It is less strongly costate than most of the group, but the costae are still apparent. It differs from *H. marginalis* (Fabricius) in having a dark instead of pale occiput and not so long antennae.

***Hystiopsis mapirii*, new species**

FIGURE 85

About 5 mm. in length, oblong oval, somewhat shiny although alutaceous, the elytra strongly costate; pale yellow, the head piceous down to antennal sockets, elytra with a short reddish brown vitta along the side below the humerus and a spot at the apical curve, suture about scutellum and below faintly reddish brown and another faint darkening near the apex, breast brown, tibiae and tarsi brownish.

Head with the interocular space approximately half width of head, occiput finely punctate, frontal tubercles not clearly marked but swollen and with a median depression above; lower front depressed and without any trace of carina, the top of head down to antennal sockets shining piceous, lower front pale yellow with the mouthparts tipped with brown. Antennae pale, except the dark tip of the terminal joint. Prothorax not twice as broad as long with somewhat curved sides and a transverse depression; surface alutaceous, finely punctate and en-

tirely pale yellow. Scutellum tan colored. Elytra strongly costate with the intervals geminate striate punctate; surface alutaceous, somewhat shiny, pale yellow with a lateral brown stripe running down the side but not reaching the middle, and a brownish spot at the apical curve of each elytron, the suture brownish about and below the scutellum and near apex. Body beneath pale with a brown breast and the tibiae and tarsi and apex of hind femora brown. Length 4.7 mm.; width 2.2 mm.

Type, female, Bowditch collection, MCZ 30683, from Mapiri River, Guanay, Bolivia, 1500 ft., August 1895.

Remarks: This is the smallest as well as palest of the species with the depressed lower front of the face. Bowditch has attached the manuscript name *mapirii* to it.

***Hystiopsis bella*, new species**

FIGURES 75, 77, 78

About 5.5 mm. in length, oblong oval, shining, although finely alutaceous, elytra strongly costate, antennae dark except the last two or three joints, head dark over occiput, pale in lower front, thorax and body beneath except the breast pale yellow, the femora pale with a dark apex, tibiae and tarsi more or less dark, elytra with a pale margin and dark piceous within, on each elytron a pale spot in the basal half variable in size and a pale fascia, varying in width, below the middle.

Head with interocular space approximately half width of head, a shallow median depression above the somewhat swollen frontal tubercles, the upper half of head deep piceous, alutaceous although shiny with fine punctation, lower front depressed, without carina and with two transverse ridges, one on either side, lower face pale, mouthparts tinged with brown. Antennae long, slender, dark brown except the terminal joints which are pale, the last joint tipped with brown. Prothorax nearly twice as wide as long with slightly curved sides and a transverse depression, alutaceous, finely punctate, entirely pale yellow. Scutellum tan colored. Elytra not very convex, each with 7 or 8 more or less distinct costae, the intervals having irregularly striate punctation; surface alutaceous but shiny, deep piceous with a pale margin and in the basal part a pale spot, sometimes enlarged to reach the base, and a broad pale fascia below the middle that occasionally is narrowed and sometimes does not reach the margin. Body beneath pale with a brown breast, the femora pale with dark apices, hind tibiae and tarsi more or less dark, in one specimen the legs entirely pale. Length 5.5–5.7 mm.; width 2.8–3 mm.

Type, male, USNM 66838; two paratypes, females, all from Loma Alta, Bolivia, collected by G. Pinckert, March 21, 1957. Other speci-

mens from Cochabamba and Beni River, Salinas, Bolivia, collected by M. Stuart, July 1895.

Remarks: There is considerable variation in the markings of this species. One specimen has entirely pale legs, in others the variation in the pale terminal joints of the antennae is noticeable, and the elytral markings vary to the extent that the basal spot may be so large as to leave only a narrow sutural and lateral dark vitta; the fascia below the middle varies from a narrow to a wide band. Bowditch has attached the manuscript name *bella* to this species.

***Hystiopsis zonata*, new species**

FIGURE 76

About 6 mm. in length, oblong oval, feebly shining, the elytra strongly costate with the intervals striately punctate, the head down to antennal sockets piceous, pale yellow in lower front, antennae brown with the apical joints paler; prothorax pale, elytra piceous with a pale margin and a pale transverse fascia below the middle; body beneath pale with the breast dark, femora pale with a dark streak; tibiae and tarsi piceous.

Head with the interocular space about half width of head, occiput finely punctate, a median depression above frontal tubercles, no carina down lower front but the lower front depressed with a small transverse ridge on either side under the antennal sockets. Occiput to antennal sockets piceous, lower front pale yellow, mouthparts brown. Antennae brown with the apical joint pale and its tip dark. Prothorax not twice as broad as long with slightly curved sides and a transverse depression, entirely pale. Scutellum piceous. Elytra strongly costate, the intervals with striate, sometimes geminate punctation, alutaceous, feebly shining; dark piceous with a feeble violaceous blue lustre, the margin pale yellow and a transverse pale fascia below the middle. Body beneath pale with a piceous breast, femora pale with a dark streak above and the hind femora with a dark apex; tibiae and tarsi more or less dark, in the male the front tibiae thickened and the first tarsal joint long and wide. Length 6.2 mm.; width 3 mm.

Type, male, CAS, from Valley of the Monzon, Tingo Maria, Peru, collected by E. I. Schlinger and E. S. Ross, Sept. 18, 1954.

Remarks: The similarity of all these species with the depressed lower front of the face makes the group as homogeneous as the species of *Eucerotoma*, a group of larger beetles with stronger costae and more developed male characters. This species is a little larger than *H. bella*, and the male has more strongly dilated first front tarsal joints.

***Hystiopsis maculata*, new species**

FIGURE 81

About 6.5 mm. in length, oblong oval, shining, the elytra strongly costate with the intervals geminate striate punctate; head, antennae, undersurface, tibiae and tarsi and part of the femora dark; elytra dark with large roundish pale spots, three down the middle of each elytron and an elongate one below the humerus on the side and margin.

Head with the interocular space more than half width of head, occiput polished, impunctate, the tubercles swollen, a depression above them, lower front depressed without carina, a thin median line down the front on each side of which the surface wrinkled and with a few punctures, the head dark except a pale line along the labrum and the neck beneath also pale. Antennae long and slender, piceous with the three terminal joints deep brown. Prothorax almost twice as wide as long, widely sulcate across, alutaceous and finely punctate, entirely pale. Scutellum dark. Each elytron with 8 costae, the intervals with geminate striate punctures, shining, piceous, with three large roundish pale spots down the middle of each elytron and an elongate pale spot along the margin below the humerus; apex and epipleura pale. Body beneath with the breast and abdomen dark, basal part of femora pale, tibiae and tarsi dark, all tibiae with a spine. Length 6.5 mm.; width 2.5 mm.

Type, female, USNM 66839, from Campinas, Brazil, collected by P. A. Berry, March 19, 1939.

Remarks: This is closely related to the preceding species found in Peru and Bolivia, *H. bella* and *H. zonata*.

***Hystiopsis irritans*, new species**

FIGURE 80

About 5.5 mm. in length, oblong oval, faintly shining, alutaceous, the elytra strongly costate with the intervals geminate striate punctate, depressed along the suture below the scutellum, pale with the antennae except the terminal joints dark, the occiput dark, tibiae and tarsi dark, a dark streak along the femora, the pronotum with a dark median vitta, the elytra dark except for a large pale median spot not joined at the suture and a pale apical area.

Head with the interocular space about half width of the head, the occiput finely punctate, tubercles prominent, lower front depressed and rugose, front pale, occiput and mouthparts dark. Antennae long and dark with the three apical joints pale, no difference in the sexes. Prothorax almost rectangular, with only slightly curved sides, a well marked transverse sulcus but not so deeply carved as in

Eucerotoma; surface alutaceous and with scattered fine punctation; pale yellow with a broad median piceous vitta extending the length of pronotum and narrowed at the base. Scutellum dark. Each elytron with 8 distinct costae and the intervals geminate striate punctate; black with faint purplish lustre, in the middle of each elytron a large pale spot not reaching the suture or margin and another pale area along the apical margin to the apical curve. Body beneath with the abdomen and most of the breast dark, but the forepart of the breast pale, the mesothorax dark in the middle. Legs with the femora pale except for a dark streak on the apex, the tibiae and tarsi mostly dark. Front tibiae of the male and the first tarsal joint enlarged. Length 5–6 mm.

Type, male; one paratype, female; both in Zoologische Sammlung des Bayerischen Staates, Munich, Germany, from Guayaramerin, 150 m., Beni Gebiet, Bolivia, collected by W. Forster, 1954.

Remarks: Bechyne has labelled this as a new species of *Eucerotoma* and attached the specific name *irritans* to a specimen in the zoological collection at Munich. I have been unable to find that the name has ever been published. It does not belong to the genus *Eucerotoma* as it does not have the sexual characteristics shown in that genus, consisting of the excavate face and enlarged third and fourth antennal joints of the male. Neither do the elytral costae resemble the much stronger costae of *Eucerotoma*, and the sulcus across the pronotum has none of the intaglio-like carved impression of that genus. It belongs rather with the group found mainly in Peru and Bolivia with a depressed lower front of the head not differing in the sexes.

***Hystiopsis maxima*, new species**

FIGURE 88

Approximately 9 mm. in length, elongate oblong oval, shiny, the elytra strongly costate with geminate striate punctation in the intervals, pale yellow brown with a piceous head and the elytra with a metallic blue green lateral vitta and a shorter sutural vitta.

Head with interocular space approximately half width of head, occiput with a median depression over the frontal tubercles, lower front depressed and without a carina (no male examined); entirely piceous. Antennae long, pale, with the intermediate joints a little browner. Prothorax with slightly curved sides and a shallow transverse sulcus, reddish brown. Scutellum reddish brown. Elytra strongly costate with the intervals with geminate striate punctures, pale yellow brown with a greenish or bluish lateral vitta extending from the humerus to apical curve, and a shorter sutural dark vitta extending a little below the middle. Body beneath and legs pale,

breast piceous, a spine on all the tibiae. Length 9.2 mm.; width 4.4 mm.

Type, female, BMNH, from New Grenada (Colombia).

Remarks: Only the female is known, but the size and markings differentiate it from related species. It is larger and more strongly costate than *H. bryanti* from Trinidad.

***Hystiopsis megala*, new species**

FIGURE 82

Between 8 and 9 mm. in length, elongate oblong oval, somewhat shiny, the elytra strongly costate and the front of the head depressed, pale yellow brown with the head mostly piceous except about the mouthparts, the elytra with a dark vitta down the suture and another down the side, not reaching the middle, sometimes a median spot and also a larger apical spot often with a similar one beside it on each elytron, the breast tending to be dark.

Head with the interocular space less than half width of head, occiput finely punctate, a depression above frontal tubercles, lower front depressed, head piceous except about mouthparts, often only the jaws pale and the labrum sometimes also pale. Antennae reddish brown (terminal joints missing). Prothorax somewhat rectangular with slightly curved sides and often not a very conspicuous transverse sulcus, yellowish or reddish brown, finely punctate. Scutellum pale. Elytra wider towards apex, strongly costate with the intervals having geminate striate punctures, pale with dark markings, sometimes with a metallic lustre, a vitta from base covering humerus down the side and another from about the scutellum down the suture, neither reaching the middle, sometimes a median spot opposite the end of these and near the apex a large median spot, sometimes broken into two spots. Body beneath pale with the breast darker, often only along the sides, legs entirely pale; a spine on middle and hind tibiae. Length 8–9 mm.; width 4.2–4.4 mm.

Type, female, BMNH, Fry collection, from Ecuador, collected by Buckley; another female labelled "Cuenca" [Ecuador], and a third female, Baly collection, without any locality label.

Remarks: This is as large as *H. maxima*, but with a slightly different elytral pattern.

***Hystiopsis phaica*, new species**

FIGURE 87

About 7.5 mm. in length, elongate oblong oval, moderately shiny, the elytra costate, the intervals geminate striate punctate, pale yellowish brown with the head piceous and mouthparts somewhat paler, antennae with the intermediate joints dark, the elytra having a dark

spot on the humerus, the apex dark with 2 round pale spots in the middle, tibiae and tarsi dark.

Head with the interocular space half width of head, occiput shiny, finely punctate, a depression over the frontal tubercles, lower front depressed, without carina, piceous, except about the jaws. Antennae pale with the intermediate joints deeper brown. Terminal joints missing. Prothorax with a transverse sulcus, alutaceous, finely punctate, pale yellow. Scutellum pale. Elytra shrunken as specimen is immature, but still with signs of costae discernible, and the punctures in the intervals geminate striate, pale yellowish brown with a small spot on the humerus and at the apex a dark band with 2 median round pale spots. Body beneath pale with the breast dark; tibiae and tarsi more or less dark. Length 7.4 mm.; width 3.5 mm.

Type, female, BMNH, from Cuenca, Ecuador.

Remarks: The elytral color pattern of this species is unlike that of any other examined.

***Hystiopsis grossa*, new species**

FIGURE 84

Between 8 and 10 mm. in length, oblong oval, shining, although faintly alutaceous, the elytra with 7 or 8 feeble costae and with rather coarse geminate striate punctures in the intervals; pale yellow brown with a piceous head and dark intermediate joints of the antennae, the elytra dark with metallic green or purplish lustre, the margin, apex and four spots pale yellow brown, in one specimen the apical two spots coalesce at the suture; breast, tibiae and tarsi dark.

Head with the interocular space approximately half the width of the head, a median depression above the rather swollen but indistinctly marked frontal tubercles, occiput alutaceous and finely punctate, the lower front smooth, shining black, with very little evidence of a carina in the female (no males examined), and in some specimens the lower front somewhat concave; antennae long, the three basal and three terminal joints pale. Prothorax broad but not twice as wide as long with slightly curved sides and a rather shallow transverse depression; surface shining although alutaceous, finely punctate, entirely pale. Scutellum pale. Each elytron with 7 or 8 distinct costae, the intervals tending to be geminate-striate punctate; surface alutaceous but somewhat shiny metallic green with four large pale yellow spots, two on each elytron, the ones below the middle in one specimen coalescing at the suture, apex widely pale and the margin pale. Body beneath pale with the breast dark, femora pale, tibiae and tarsi brownish, all tibiae with spines, anterior coxal cavities open, claws appendiculate. Length 7.5–9.8 mm., width 4–5 mm.

Type, female, MCZ 30684; two paratypes, females, (one USNM); all from Cachabé [labelled "low c."], Province Esmeraldas, Western Ecuador, approximately 500 ft., collected by Rosenberg, December 1896; one female, BMNH, Baly collection, without locality label.

Remarks: The large size and the dark elytra with the pale spots make this species easily recognized. Most of the species of this genus have been collected in the Andes or from the eastern side of the Andes, but this was taken in western Ecuador in the low country.

***Hystiopsis exarata*, new species**

FIGURE 74

Between 4.5 and 7 mm. in length, oblong oval, faintly shining, the elytra costate with the intervals geminate striate punctate, pale yellow brown with piceous tibiae and tarsi; the elytra often with metallic blue or purplish markings on the humerus, below the scutellum along the suture, a large spot on each elytron slightly below the middle and a smaller spot at the apical curve, these markings often evanescent in part or enlarged to form three fasciae across the elytra.

Head with the interocular space a little more than half the width of the head, occiput alutaceous and finely punctate, the frontal tubercles swollen, a median depression above, no carina down the lower front but sometimes a median elevated line, the lower front depressed, entirely pale yellowish brown. Antennae brown with the three basal and three terminal joints pale. Prothorax nearly twice as wide as long with curved sides and a transverse sulcus, shining, impunctate, pale yellow brown. Scutellum pale. Elytra costate, the intervals with coarse geminate-striate punctures, finely alutaceous but somewhat shiny, pale yellow brown with often pale metallic blue or purplish markings consisting of a spot covering the humerus, a long spot on each side of the scutellum and a little way down the suture, a large spot nearly across the elytra but usually not joined at the suture in the middle, and a lateral spot near the apex, the suture narrowly dark at this point; these markings sometimes enlarged to form three fasciae across the elytra, or again the spots in part evanescent. Body beneath pale with the breast sometimes darker, femora pale, tibiae and tarsi dark. All tibiae with a spine. Length 4.5–7 mm.; width 2–3.7 mm.

Type, female, MCZ 30685, from Brazil.

Remarks: This species is represented mostly by females, only one male being examined, most are very old specimens. There is one specimen, USNM, from Buenos Aires, ten specimens, BMNH, all from Bahia and Rio de Janerio, Brazil. The most recent specimen found was collected by G. E. Bryant at Corcovado, Rio de Janeiro, May 8, 1912. The only male examined does not show any head or

antennal differences from the female. On two old specimens of the British Museum is the Dejean Catalogue name "*Cerotoma exarata.*"

Eccoptopsis, new genus

Elongate oblong oval, the head with the eyes widely set and the face of the male more or less deeply excavated, often with spines, the third and fourth antennal joints in the male usually swollen and always excavated at the adjoining ends. Antennae in the female with the third joint usually longer than the fourth, rarely equal, never shorter. Prothorax with a more or less distinct transverse sulcus, sometimes only marked by a depression on each side. Elytra usually with distinct costae, but in some species only feeble traces of costae, the punctation in the intervals being geminate striate. Anterior coxal cavities open, the tibiae with a spine, the first tarsal joint of the middle and hind legs long, claws appendiculate.

Type species: *Neobrotica denticornis* Jacoby.

Remarks: This genus has been erected for some species that have been assigned to the genus *Neobrotica* but which are in reality intermediate between that genus and *Eucerotoma*. They resemble both *Cerotoma* and *Eucerotoma* in the development of the sexual characteristics of the male in having the face excavated and the third and fourth antennal joints cut out. In the female the third antennal joint is usually longer than the fourth, rarely equal to it, and never shorter. There is considerable variation in the extent of development of these male characters. In some species, such as *Neobrotica denticornis* Jacoby, the face and antennae resemble species of *Cerotoma* or *Eucerotoma*. In two other species, one of them *Neobrotica cavifrons* Jacoby, there is a different modification of the antennal joints as well as differences in the face in the male. And in three South American species, the third and fourth antennal joints are only slightly swollen, but have the excavation at the adjoining ends, and the face is only shallowly excavate but with spines.

This genus is distinguished from *Cerotoma* by having the anterior coxal cavities open; from *Eucerotoma* it is distinguished by having the elytra usually considerably less costate and the prothorax with a transverse sulcus, like that found in *Neobrotica*, not so deeply carved as in *Eucerotoma*. It is distinguished from *Neobrotica* and *Hystiopsis* by the development of the male characters in the antennae and face. And it is distinguished from *Eucerotoma*, *Neobrotica* and *Hystiopsis* by having the third antennal joint in the female longer than (rarely equal to) the fourth joint, never shorter as is the case in *Eucerotoma*, *Neobrotica* and *Hystiopsis*.

The name *Eccoptopsis* is derived from the Greek ἐκκόπτω, meaning "cut out" and ὄψις, meaning "face."

Key to Species of *Eccoptopsis*

1. Elytra entirely dark except the margin 2
   Elytra not entirely dark 3
2. Elytra strongly costate, Brazil . . . **cyanocosmesa,** new species (p. 346)
   Elytra only feebly costate, Argentina . **argentinensis,** new species (p. 347)
3. Elytra dark with four pale spots . . **quadrimaculata,** new species (p. 350)
   Elytra not dark with four pale spots 4
4. Elytra with a basal and an apical fascia 5
   Elytra not with a basal and an apical fascia 6
5. Prothorax twice as wide as long, Costa Rica . **laticollis,** new species (p. 342)
   Prothorax not twice as wide as long, Peru . . **clara,** new species (p. 344)
6. Elytra distinctly and usually strongly costate 7
   Elytra at most only feebly costate 9
7. Occiput of head piceous, Costa Rica . **costaricensis,** new species (p. 341)
   Occiput of head pale 8
8. Prothorax approximately twice as wide as long, Bolivia.
   boliviensis, new species (p. 343)
   Prothorax not twice as wide as long, Central America.
   denticornis (Jacoby) (p. 340)
9. Third and fourth antennal joints in male not noticeably enlarged and inconspicuously excised at adjoining ends.
   piceofasciata, new species (p. 345)
   Third and fourth antennal joints in male much widened and much excised at adjoining ends 10
10. Elytra pale with a lateral dark vitta from humerus to apical curve and a short sutural vitta to the middle and on each elytron three spots in a row between vittae . . . . . **mexicana,** new species (p. 348)
    Elytra mostly dark with a pale median vitta that turns horizontally to the margin and at apex another pale curving ring enclosing a dark sutural spot . . . . . **cavifrons** (Jacoby) (p. 347)

Eccoptopsis denticornis (Jacoby)

FIGURE 91

Neobrotica denticornis Jacoby, *in* Godman and Salvin, Biologia Centrali-Americana, Coleoptera, vol. 6, pt. 1, p. 578, 1887.

About 6 mm. in length, oblong oval, shining, the elytra strongly costate, pale yellow with deep brownish or even piceous markings across the elytra in the shape of a humeral spot, a spot common to both elytra below the scutellum on the suture, a band across the middle sometimes interrupted at the suture, and another before the apex, sometimes lunate or sometimes abbreviated to a spot on each elytron. Antennae in the male with the third and fourth joints deformed, much swollen and excavated at adjoining ends, and the head with the front excavated and having odd developments in the shape of shelving and spines.

Head with the interocular space more than half width of head, the frontal tubercles swollen and a median depression above them, lower front in female slightly excavate and with no trace of a carina down

the front, in the male there is a similar lack of carina, the front directly below the antennal sockets being scooped out and on either side a projecting shelf curving downwards over a deeply excavated lower front, on each side of which is a strongly curved long spine. Antennae in the female with the third joint longer than the fourth, in the male with the third joint swollen and excavate at the apex, the fourth joint excavated at the end joining the third and somewhat swollen, similar to the development in species of *Cerotoma*, pale with the intermediate joints brownish and the three terminal joints pale yellow. Prothorax not twice as broad as long, somewhat rectangular, with the sides slightly curved, almost straight in some specimens, and a well developed transverse sulcus, shining, finely punctate. Scutellum pale. Elytra shining, strongly costate, the intervals with coarse geminate-striate punctation, pale yellow with reddish brown to piceous markings, a humeral spot, a spot below scutellum common to both elytra, a fascia that may be broken into spots across the middle and another before the apex, the last frequently lunate in shape or sometimes reduced to a spot. Body beneath entirely pale, the femora pale, tibiae and tarsi brownish, all tibiae with a spine, claws appendiculate, anterior coxal cavities open. Length 6–6.5 mm.; width 3.3–3.5 mm.

Type, male, BMNH, from Chontales, Nicaragua, collected by Janson.

Other localities: Cubilguitz, Vera Pas, and Paso Antonio, Guatemala, 400 ft., collected by Champion. Punta Garda, British Honduras, collected by Peck, Sept. 10–20, 1906. Trinidad River, Panama, collected by A. Busck, May 6, 1911; Porto Bello, Panama, collected by E. A. Schwartz, May 1, 1911, and by A. Busck, Feb. 18, 1912; Cabima, Panama, collected by A. Busck, May 27, 1911. Ciricito, Canal Zone, collected by R. E. Blackwelder, March 1930.

***Eccoptopsis costaricensis*, new species**

FIGURE 89

About 8 mm. in length, oblong oval, somewhat shiny; in the male the front of the head excavated and the third and fourth antennal joints swollen and excavated at adjoining ends, the prothorax deeply sulcate, the elytra with feeble costae and with shallow geminate-striate punctation between the costae, pale yellow brown with the head on top piceous, the elytra with reddish brown markings.

Head with interocular space approximately half width of head, a deep median depression above the frontal tubercles, occiput piceous, this deep color decreasing in lower front so that the mouthparts are yellowish brown; under each antennal socket in the male a broadly rounded shelf with long hairs, beneath which the lower front is deeply excavated, and on each side a long curved spine. Antennae in the

male with a very long basal joint, a short compressed second joint, the third joint swollen and excavated near the apex, the fourth joint swollen and excavated in the basal portion, remaining joints long and slender (the last three missing), pale yellow brown with the first three on the outside touched with deep piceous. In the female the third joint is approximately equal to the fourth. Prothorax nearly twice as wide as long with slightly rounded sides and a deep transverse sulcus, entirely yellowish brown, nearly impunctate. Scutellum pale. Elytra wider in apical half, rather depressed with a short intrahumeral sulcus and feeble costae, the intervals being obsoletely geminate-striate punctate; pale yellow brown with reddish brown markings on the humerus, about scutellum and a little way down the suture, a broad fascia before the middle not extending to the suture and a rounded half circle of two spots before the apex on each elytron. Body beneath yellow brown with the breast deep reddish brown, legs entirely pale; first tarsal joint in all legs unusually long, anterior coxal cavities open, claws appendiculate. Length 8 mm.; width 4 mm.

Type, male, USNM 66855, from Piedra Negra, Costa Rica, collected by Schild and Burgdorf; paratype, female, from same collection.

Remarks: The second specimen, a female, has a slightly different coloration, the entire head being yellow brown, the markings on the elytra are more indistinct, but of the same pattern, and the underside is entirely pale. A third specimen, also a female, from Waldeck, Costa Rica, collected by C. H. Ballou, has also a pale head and undersurface, but more distinct reddish-brown elytral markings of similar pattern. Still another male, from Lolola, Costa Rica, collected June 22, 1957, on cacao by M. J. Stelzer, is of similar coloring. In all of these specimens the elytral sculpture is like that of the type, and in this respect differs from *denticornis* in which the costae are very distinct and the punctation deep and coarse. The third antennal joint in the female is about equal to the fourth, whereas in *denticornis* it is a little longer in most specimens.

***Eccoptopsis laticollis*, new species**

FIGURE 92

From 5 to 6 mm. in length, oblong oval, shining, the face in the male excavate and antennal joints three and four swollen and excavated at the adjoining ends, prothorax with a scooped-out depression in the lower half and the elytra strongly costate, pale yellow; the occiput of the head piceous, a broad dark blue basal elytral fascia and another before the apex, the former sometimes enclosing a pale spot; legs, undersurface and antennae pale.

Head wide, with the interocular space more than half width of head, occiput smooth and shining with a median depression, piceous to the antennal sockets, lower front pale yellow to below the excavation, then piceous with a piceous mouth; in male lower front below a broadly projecting shelf edged with long hairs under each antennal socket, deeply excavated, and on either side a long strongly curved spine. Antennae long, in the male the basal joint very long, second joint knoblike and short, third broad and excavated at the end, fourth broad and excavated at the base, remaining joints long and subequal, pale yellow with the first three joints with a piceous spot on the outside, joints five to eight deep brown, tip of terminal joint also dark. Prothorax almost rectangular, approximately twice as broad as long, impunctate, shining pale yellow. Scutellum pale. Elytra broad and a little wider at apical end, humeri well marked with a deep intrahumeral sulcus; surface irregularly costate, the intervals rugose with obsolete geminate-striate punctation, shining, pale yellow; a broad deep blue fascia extending across the base, sometimes with a small pale spot in it, and another broad dark blue fascia near the apex and interrupted at the suture. Body beneath and legs entirely pale yellow, anterior coxal cavities open, claws appendiculate, all tibiae with a spine, front tibiae in the male stout and the first basal joint of tarsi cylindrical. Length 5.2–6 mm.; width 2.6–2.8 mm.

Type, male, MCZ 30677, Port Limon, Costa Rica, collected by P.J. Darlington, May 9, 1959; one paratype, male, USNM, same locality.

Remarks: This species is closely related to *denticornis* (Jacoby), but it has a different elytral pattern and not so well marked elytral costae or so deep punctation. The head and prothorax are wider too. In the structure of the antennae and the excavated front of head in the male the two species are similar.

***Eccoptopsis boliviensis*, new species**

FIGURE 90

About 7 mm. in length, elongate oblong oval, faintly shining, the prothorax nearly twice as wide as long with a transverse sulcus, the elytra strongly costate to apical curve, and the intervals geminate striate, pale yellow brown; the elytra with reddish brown markings, consisting of a lateral vitta from the humerus nearly to apex, a spot in the middle near the base, a median fascia connected both on the side and at suture with a curved fascia near the apex, body beneath and legs pale, the tibiae slightly brownish, this description being of the female, the male unknown.

Head with interocular space half width of head, a rounded median depression over the frontal tubercles, no carina between antennal sockets or down front but the lower front depressed in the female,

and probably deeply excavate in the male; pale yellow brown with the tips of jaws brownish, impunctate. Antennae not extending to the middle of the elytra; in the female with the third joint long, the remainder shorter and subequal, pale with a slight deepening in color in the intermediate joints; the third and fourth joints in the male probably deformed. Prothorax nearly twice as wide as long, with slightly rounded sides and a transverse sulcus, alutaceous, nearly impunctate, entirely pale yellow. Scutellum pale. Elytra long and strongly costate, with 8 or 9 costae on each elytron, the intervals being coarsely geminate punctate, pale yellow brown with deep reddish brown markings consisting of a lateral vitta extending from the humerus nearly to the apex, a median spot near the base, and a median and apical fascia, both connected along the suture and side, the apical fascia semilunate. Body beneath entirely pale, legs pale with a slight brownish tinge along the lower tibiae, anterior coxal cavities open, claws appendiculate, middle and hind tibiae with a spine. Length 7 mm.; width 3.5 mm.

Type, female, MCZ 30678, from Salinas, Beni River, Bolivia, collected by M. Stuart, July 1895.

Remarks: The single female from which this species is described was among the specimens under *N. denticornis* Jacoby in the Bowditch collection. In its elytral pattern it is similar to but unlike that species in having a dark lateral vitta as well as a shorter dark sutural one. Although no male has been examined, the male undoubtedly has the front of the face excavated and some peculiarity of the third and fourth antennal joints such as occurs in *denticornis*. In the female the third antennal joint is longer than the fourth, as is usual in this genus.

***Eccoptopsis clara*, new species**

FIGURE 93

Between 7 and 7.5 mm. in length, elongate oblong oval, shining, the head in the male excavate, and the third and fourth antennal joints enlarged and cut out at adjoining ends, the prothorax with a transverse depression, the elytra with a broad basal and apical dark blue fascia, the breast, tibiae and tarsi dark brown.

Head in male with an excavation below the antennal sockets and on either side a rounded shelf fringed with long hairs and curving down over the hollowed out lower front; in the female the area below the antennal sockets shallowly scooped out without any trace of a carina, frontal tubercles in the male swollen with a depression above them, in the female not so swollen, a median depression above; interocular space more than half width of head, head entirely black and shiny. Antennae in male with the basal joint enlarged, the third and fourth joints much enlarged and excavate at the apex of the third

and base of the fourth, the first four basal joints pale, joints five to nine brown; in the female the first eight joints dark brown, the ninth pale, the rest missing. In the female the third antennal joint about equal to the fourth. Prothorax wider than long with almost straight sides and a transverse sulcus, shining pale yellow brown with scattered punctures. Scutellum pale. Elytra slightly wider towards apex, with feeble costae, not so marked in the female, and dense but not contiguous geminate-striate punctation; shining pale yellow brown with a broad blue fascia in basal half of elytra and another before the apex, the margins and apex being pale. Body beneath pale except for the brown breast, femora pale, tibiae and tarsi dark brown, the tarsal claw joint pale, all tibiae with a spine; anterior coxal cavities open, claws appendiculate. Length 6.8–7.5 mm.; width 2.5–3.5 mm.

Type, male, MCZ 30679; one paratype, female, USNM; both from Peru.

Remarks: This species with its narrow elongate shape and elytral blue fasciae resembles *Neobrotica coeruleofasciata* Jacoby, but the male characters of the excavate face and swollen antennal joints place it near *denticornis* and its relatives. Unlike the rest of the genus, the third antennal joint in the female is the same length as the fourth.

***Eccoptopsis piceofasciata*, new species**

FIGURE 95

About 7 mm. in length, elongate oblong oval, dull, alutaceous, the elytra strongly punctate, the prothorax with a transverse sulcus, the head in the male with the lower front depressed and with a small shelf under each antennal socket, the elytra feebly costate, reddish brown, the elytra with dark brown or piceous bands.

Head with the interocular space half width of the head, occiput punctate, a depression over the frontal tubercles, lower front depressed; in the male with a slight shelf under each antennal socket and a short spine in the middle of lower front; shiny yellowish or reddish brown. Antennae with the basal joints pale reddish brown, the intermediate joints dark brown, and the three terminal joints pale yellow; in the male the third joint long but not swollen and at the apex excavated, the fourth joint at the base very slightly excavated. Prothorax slightly shiny although alutaceous and finely punctate, with a transverse sulcus, reddish or yellowish brown. Scutellum pale. Elytra wider towards apex, strongly alutaceous with feeble costae and strong punctures in the intervals; reddish or yellowish brown. A dark brown or piceous band near the base, a median one interrupted at the suture and a third near the apex enveloping a large round pale spot on each elytron at the apex. Body beneath entirely reddish or yellowish brown, with the tibiae and tarsi deep

brown or piceous, front tibiae and first tarsal joint in the male much enlarged. Length 6.5–7.5 mm.; width 3–4 mm.

Type, male, BMNH, from the Amazon region, Brazil; other specimens from Peru.

Remarks: This species has the smallest alteration in the male antennae of any so far described in the genus, the third and fourth joints being barely perceptibly swollen and the tiny excavation of the third and fourth joints being almost unnoticeable. The development of the shelf under each antennal socket and the median spine in the face of the male is more or less typical of the other species.

Eccoptopsis cyanocosmesa, new species

FIGURE 98

About 6.5 mm. in length, broadly oblong oval, shining, the head in the male somewhat excavate and the antennae with the third and fourth joints swollen and excavated at the adjoining ends, the prothorax with a deep transverse sulcus, the elytra strongly costate, the intervals with geminate-striate punctures, yellow brown with the elytra dark greenish blue except for the pale margin; antennae more or less piceous and the tibiae and tarsi deep brown.

Head with the interocular space approximately half the width of the head, occiput smooth, shiny, finely punctate, a depression above the well marked frontal tubercules, lower front in the male shallowly excavated below the antennal sockets, a short median spine below this and a shorter one on each side, entirely yellow brown except for the brown jaws. Antennae in the male with the third joint somewhat swollen and excavated near the apex and the fourth joint excavated at the base, the rest subequal and slender, dark brown. Prothorax nearly twice as wide as long with rounded sides and a deep transverse sulcus across the middle, shining although alutaceous, finely punctate, yellow brown. Scutellum pale. Elytra alutaceous with distinct costae and between them rather coarse geminate-striate punctures; dark green or blue, with a pale margin a little wider near the apex, the apex somewhat pinched in. Body beneath entirely pale, in one specimen the color of the breast darker, femora pale, tibiae and tarsi dark. Anterior coxal cavities open, the claws appendiculate, a spine on the middle and hind tibiae, the anterior tibiae of the male stout and the first tarsal joint long and dilated at the base. Length 6.5 mm.; width 3.3 mm.

Type, male, BMNH, Sharp collection, from Brazil.

Remarks: A second mutilated specimen in the British Museum from "Rio" has deep blue elytra. There are eight old specimens, mostly bluish, in the Bowditch collection, one from Rio de Janeiro, four without labels, and one from South America and two from Brazil.

The only recently collected specimen is a male in the Carnegie Museum from Rio de Janeiro. Although lacking the shelf below the antennal sockets of the male that is prominent in the Central American species, and not having so deeply excavated a front as in those, this species appears to be the South American counterpart of *E. denticornis* and its relatives and fits into the genus very well.

***Eccoptopsis argentinensis*, new species**

FIGURE 99

From 5.5 to 6.5 mm. in length, broadly oblong oval, shining although alutaceous, the head of the male a little excavated and antennal joints three and four somewhat swollen and excavated at adjoining ends; prothorax transversely sulcate, elytra feebly costate with geminate-striate punctures between; yellow brown with blue or greenish elytra having a pale margin.

Head with the interocular space about half the width of the head, in the male the lower front a little excavated with a median spine below the antennal sockets and two short spines on either side, in the female a feeble carina down the front which bulges a little. Antennae in the male with a long basal joint, a short second joint, the third and fourth long and excavated, the remainder slender and subequal, reaching about to the middle of the elytra. In the female the third joint longer than the fourth. Scutellum pale yellow brown. Elytra dark violet blue or greenish with a pale margin, alutaceous, faintly costate with geminate-striate punctation in the intervals, the costa on the side being more pronounced in the male, the apex somewhat pinched in. Body beneath with the breast and abdomen brownish, the femora pale except at the apex, the tibiae and tarsi brown, a spine on the hind tibiae; anterior tibiae of the male stout and the first tarsal joint broadly cylindrical as well as long. Anterior coxal cavities open, claws appendiculate. Length 5.5–6.8 mm.; width 3–4 mm.

Type, male, BMNH, Baly collection, from Entre Rios, Argentina, collected by Camille van Voixem; other specimen from Constancia, collected by H. Clark, January 1857.

Remarks: This is closely related to *E. cyanocosmesa*. It is not so distinctly costate and is less densely punctate.

***Eccoptopsis cavifrons* (Jacoby)**

FIGURE 97

Neobrotica cavifrons Jacoby, *in* Godman and Salvin, Biologia Centrali-Americana, Coleoptera, vol. 6, pt. 1, p. 758, 1887.

About 5.5 mm. in length, oblong oval, shining, the elytra rather finely and not densely punctate, with lightly raised costae, the head of the male excavate in front, the antennae of male with the third and

fourth joints swollen and excavated at adjoining ends, the prothorax with a shallow round depression on each side, reddish yellow; the elytra piceous with pale yellow diagonal vitta from the middle of the base curving at the middle of the elytron and extending downwards to the lateral margin, another pale curved vitta on each elytron forming a circle at the apex.

Head with interocular space more than half width of head, tubercles swollen over the antennal sockets, in the male the lower front scooped out with a small tooth in the middle, and the sides rising smoothly bowl-like; in the female a slight depression in the lower front and no spine; labrum rather short, hairy and like the occiput reddish brown, paler in the lower front. Antennae in the male with the third joint much swollen and excavate at apex and the fourth joint with an apical tooth, the rest rather short and subequal, all reddish brown; in the female the third joint much longer than the fourth or succeeding joints which are subequal. Prothorax not twice as wide as long with the sides a little rounded, the disc with a rounded depression on each side, reddish brown. Scutellum black, shining. Elytra shining, piceous, with faint costae and fine punctures tending to be geminate striate, the margin pale yellow and a pale vitta extending somewhat diagonally from the base to the middle, then abruptly curved towards the margin, another pale vitta on each elytron from the suture curved about to form a circle at the apex. Body beneath dark except the sides of the prosternum, femora reddish brown, sometimes streaked with black on the outside, the tibiae reddish brown, sometimes with a darker outer color and the tarsi reddish brown or darker. Anterior coxal cavities open, claws appendiculate. Length 5.6–6 mm.; width 2.7–3.6 mm.

Type, male, BMNH, from La Parada, Mexico collected by Sallé.

Remarks: Jacoby wrote that he had seen only a single specimen of this, a male, which is in the British Museum now. There is one male specimen in the Bowditch collection of the Museum of Comparative Zoology, labelled "Boucard, Mex. coll.", and one female specimen in the U.S. National Museum from 5 miles east of C. (?Ciudad) del Maiz, 4700 ft., Mexico, collected by R. R. Dreisbach, Aug. 25. 1954, from the Monrós collection. In this female specimen the third antennal joint is longer than the fourth or succeeding joints.

***Eccoptopsis mexicana*, new species**

FIGURE 96

Approximately 6.5 mm. in length, oblong oval, faintly shining and somewhat alutaceous, the antennae in the male with the third joint long and swollen and excavate at the end, the fourth joint hollowed out, the lower front of the head in the male scooped out and with a

median spine; prothorax with a rounded depression on each side; pale yellowish brown, the femora and front tibiae pale with a dark outer streak, other tibiae and tarsi dark, lower surface dark, the elytra with an irregular dark lateral vitta not reaching the apex and a sutural vitta extending down to the middle, on each elytron three irregularly shaped dark spots down the middle.

Head with the interocular space more than half the width of the head, occiput smoothly rounded, shining, impunctate, with a median depression over the somewhat swollen frontal tubercles that are marked by a depressed line only; in the male no carina but the lower front scooped out in the middle into a bowl-like depression from which protrudes a long thick spine; head entirely pale except for the brownish tips of the jaws. No female known. Antennae not extending to the middle of the elytra, yellowish brown becoming a little deeper in color towards the end, in the male the third joint long and swollen with a lateral long depression that divides it into a sort of upper and lower lip, the lower one protruding at the end and united with an excavated and upwardly curved fourth joint, the remainder of the antennal joints short, subequal and filiform. Prothorax somewhat rectangular with only slightly curved sides and on the disc a rounded depression on each side, surface slightly alutaceous, faintly shining, impunctate, pale yellowish brown. Scutellum dark. Elytra with faint traces of two or three raised lines, distinctly but not coarsely punctate, the punctures tending to be striate and becoming less distinct on the sides and at apex; pale yellow, each elytron with an irregularly outlined lateral piceous vitta extending from the humerus to about the apical curve but not reaching the apex or margin, a sutural vitta extending to the middle and three large irregularly shaped spots down the middle, the apical one being subvittate and close to the suture. Body beneath with neck, middle of prosternum, breast and abdomen black, the anterior coxal cavities open, femora pale except a dark outer streak, front tibiae of male with a dark outer streak, swollen, and the first tarsal joint cylindrical, front tarsal joints pale, but the middle and hind tibiae and tarsi entirely dark, middle and hind tibiae with a short spine; claws appendiculate. Length 6.6 mm; width 3.5 mm.

Type, male, USNM 66837, from Zacapu, Michoacan, Mexico, collected by J. J. MacKelvey, July 28, 1951.

Remarks: This is closely related to *Eccoptopsis cavifrons* (Jacoby) having a similar structure in the male antennae and the excavated front of the head, and even the elytral dark markings although much abbreviated appear to have the same general pattern as in *cavifrons*. But the third antennal joint in the male is heavier and longer than in *cavifrons* and slightly differently shaped.

***Eccoptopsis quadrimaculata*, new species**

FIGURE 94

About 7 mm. in length, oblong oval, shining, the elytra with a bronzy lustre, in the male the third and fourth antennal joints swollen and excavate near the end, and the front of the head excavate, elytra strongly costate with punctures between, piceous with four large pale yellow brown spots, the side margin and apex also pale; head, breast, tibiae and tarsi and part of femora dark.

Head in male with a deep excavation in the middle of the front below the antennal sockets, a rounded shelf with a fringe of hairs overhanging the transverse depression across the whole front on either side, the upper half of head dark, the lower depression pale yellow brown, labrum dark; head in the female with somewhat swollen frontal tubercles, no carina below but a slight depression, surface of lower front rugose with a slightly elevated median line; frontal tubercles in the male more bulging than in the female. Antennae dark, in the male the basal joint swollen, second joint very short, third and fourth joints widened and cut out, paler in color, remainder long and slender, in the female the joints slender and the third joint longer than the fourth, the last three pale. Prothorax about one-third wider than long with a deep curved transverse depression, shining, pale yellow brown, obsoletely punctate. Scutellum brownish. Elytra widened towards apex, shining, strongly costate, the intervals geminate punctate with the punctures often confluent, producing cross wrinkles between the costae; piceous with a bronzy lustre, on each elytron two large pale yellow brown spots, one before, the other, larger, and after the middle, the lateral margin in part pale, the apex pale. Body beneath with the breast dark, the rest pale, the femora pale with a dark streak, tibiae and tarsi dark. Length 6.8–7.5 mm.; width 3.2–3.6 mm.

Type, male; three paratypes, female; USNM 66836, all from Villavicencio, Colombia, collected by H. Dybas, July 12, 1938; another specimen, AMNH, from Rio Guayuriba, Meta, Colombia, collected by L. Richter, December 1946.

Remarks: This species is a connecting link between the two genera, *Eucerotoma* and *Eccoptopsis*, combining the deeply impressed transverse sulcus of the prothorax that is typical of *Eucerotoma* with the somewhat less deeply costate elytra of *Eccoptopsis*. In its coloration it resembles more the species of the latter genus, and like them has the third joint of the female antennae longer than the fourth, which is not the case in *Eucerotoma*. But as in *Eucerotoma* the anterior coxal cavities are only slightly open.

Potamobrotica, new genus

Head with a very short carina, a mere knob vanishing below the antennal sockets; antennae filiform, with the third, fourth, and fifth joints long and subequal, remaining joints somewhat shorter, but not as short as in *Cerotoma;* prothorax rather short and broad with a transverse sulcus. Elytra coarsely and densely punctate, the punctures tending to be striate; traces of costae. Anterior coxal cavities closed, claws appendiculate.

Type species: *Potamobrotica trifasciata*, new species.

Locality: All three species of this genus are from the Amazon part of Brazil, one extending into Venezuela.

Remarks: Except for the head with the very short carina visible only between the antennal sockets, and the closed anterior coxal cavities, this genus is similar to *Neobrotica*. However, the prothorax is a little shorter and broader. The genus differs from *Cerotoma* in not having the third antennal joint longer than the fourth. The antennae in this respect resemble most species of *Neobrotica*. No male of any of the three species has been examined, so there is the remote possibility that there are sexual differences in the face and antennae.

The name *Potamobrotica* is derived from the Greek ποταμός, meaning "river," and βρώτικα, meaning "voracious."

Potamobrotica trifasciata, new species

FIGURE 102

Between 7 and 8 mm. in length, oblong oval, feebly shining, alutaceous, the elytra densely and coarsely punctate and feebly costate, pale reddish or yellowish with deep brown markings on the head and three deep brown fasciae on the elytra often interrupted at the suture and sometimes connected along the lateral side.

Head with the interocular space almost half width of head, carina short, only a little knob between the antennal sockets, below it the front depressed and then swollen transversely over the labrum, frontal tubercles distinctly marked and with a median depression above, occiput well rounded, reddish brown, lower front pale yellowish brown. Antennae pale brownish, the ninth joint pale yellow and two apical joints deep brown. Prothorax almost rectangular with slightly curved sides and a well marked transverse sulcus, alutaceous, very finely and inconspicuously punctate, pale yellowish brown. Scutellum pale. Elytra alutaceous, not shiny, densely and coarsely punctate, the punctures tending to be striate, surface somewhat rugose with indistinct traces of costae, yellowish brown with three deep chocolate colored fasciae not reaching base, apex, suture or margin in one specimen, the fasciae at base in three of the four specimens broken into two spots.

Body beneath and legs entirely pale; anterior coxal cavities closed, claws appendiculate. Length 7.3–7.8 mm.; width 3.6–3.8 mm.

Type, female, USNM 66840; one paratype, female, John A. Wilcox collection, from Caura River, Suapure, Venezuela, collected by E. A. Klages, March 12, 1899; two other specimens in USNM, from Manaos, Brazil, collected by F. Knab.

Remarks: This is closely related to *Potamobrotica brasiliensis* (Bowditch).

***Potamobrotica brasiliensis* (Bowditch)**

FIGURE 100

Neobrotica brasiliensis Bowditch, Psyche, vol. 20, p. 128, 1915.
Andrector brasiliensis (Bowditch).—Bechyne, Ent. Arb. Mus. G. Frey, vol. 7, no. 8, p. 606, 1958. [Not correctly identified.]

About 5½ mm. in length, elongate oblong oval, moderately shining, elytra alutaceous, distinctly punctate, the punctures tending to be striate, head reddish yellow, the thorax with a touch of green (? not all green in living specimens), elytra with the yellowish areas having a greenish tint, two deep brown basal spots, a broad dark median fascia extending along the suture and sides, and a large dark apical spot on each elytron. Anterior coxal cavities closed.

Head with the interocular space half width of head, occiput rounded, finely punctate, orange yellow becoming paler in lower front, a median depression over frontal tubercles and below them a narrow and not much elevated short carina. Antennae with the three basal and three apical joints yellow, the terminal one with a dark tip, and the intermediate joints dark brown. Prothorax considerably wider than long with rounded sides, finely and moderately densely punctate, and with a well defined transverse sulcus, pale greenish on sides and in sulcus (? green faded to yellow elsewhere). Scutellum brownish. Elytra with the pale areas yellow having a slightly greenish tint, most marked on the sides and explanate margin, with deep brown fasciae, the basal one broken into two spots on each elytron, not joined at the suture, the middle fascia entirely across the elytra and tending to join at the suture and sides with the other fasciae, the apical fascia interrupted at the suture. Surface alutaceous, punctation rather coarse, shallow and tending to be striate. Body beneath pale with the breast reddish brown, femora pale, tibiae with dark outer streak, tarsi more or less bicolored. Length 5½ mm.

Type, female, MCZ, from Porto Velho, Rio Madeira, Brazil, collected by Mann and Baker.

Remarks: Bechyne has placed this as a species of *Andrector*. I have examined the specimen he identified as this in the Frey Museum and it is not *brasiliensis*, but it is the succeeding species that I am describing as *Potamobrotica viridis*, new species. No males of any of

these three species have been examined, but in all the females the third antennal joint is not longer than the fourth, which is not true of species of *Cerotoma* or *Andrector*.

***Potamobrotica viridis*, new species**

FIGURE 103

About 6 mm. in length, elongate oblong oval, not shining, the elytra densely, coarsely and tending to be striately punctate, bright green, the elytra with reddish brown lunate markings at base and near apex, the antennae with the intermediate joints brown, abdomen in places yellowish, probably faded from green, tibiae somewhat deeper brown. Anterior coxal cavities closed, claws appendiculate.

Head with interocular space about half width of head, a median depression over the faintly marked frontal tubercles, finely punctate over the occiput; carina very short and in lower front not elevated; green with the occiput deeper in color, mouthparts brownish. Antennae pale with joints five to eight and tip of terminal joint brownish. Prothorax nearly twice as wide as long, with slightly rounded sides and transverse sulcus, surface finely punctate, entirely green. Scutellum green. Elytra wider apically, a short intrahumeral sulcus, in one specimen traces of costae; punctation very close, almost contingent, coarsely and irregularly striate; surface alutaceous, not at all shiny; bright green with deep reddish brown markings in the form of a half circle at base and apex of each elytron, these marks often broken into spots. Body beneath green, in some specimens faded to more or less uniform yellow. Anterior coxal cavities closed, the middle and hind tibiae with spine, claws appendiculate. Length 5.8–7.5 mm; width 3.2–4 mm.

Type, female, BMNH, Baly collection, from "Amazon."

Remarks: There are three specimens, all females, in the British Museum all from the Baly collection, but only one with a legible locality label. A single female without any label is in the Bowditch collection, and another female in the U.S. National Museum, all old and faded. This is the species that Bechyne wrongly identified as *Neobrotica brasiliensis* Bowditch (from a specimen in the G. Frey Museum, also a female), and placed in the genus *Andrector*.

***Rachicephala*, new genus**

Elongate oblong oval, the head with wide-set eyes, protuberant frontal tubercles; in the male an excavated lower front with forward protruding appendages on each side above the labrum, and a long median spine below the antennal sockets; in the female no such appendages or spine but the lower front uneven with a small depression on each side and in the middle. Antennae in the male with the first

joint swollen, second small, third widened in basal part, then narrowed with an outer hook, and at apex much narrowed, joints four to six long, thence the joints becoming shorter. In the female, joints three to five long and filiform and the remaining joints shorter. Prothorax rather depressed and with a faint transverse sulcus, often only marked at the ends, a narrow and inconspicuous lateral edging, scarcely a margin, with a blunt tooth at the base. Elytra long, faintly costate, with the intervals irregularly striate punctate; epipleura vanishing before the apical curve; anterior coxal cavities open, legs long and slender, the first tarsal joint of all feet long, claws appendiculate.

Type species: *Neobrotica vittatipennis* (Jacoby).

Remarks: The name *Rachicephala* is derived from the Greek ῥάχις meaning "spine," and κεφαλά, meaning "head."

***Rachicephala vittatipennis* (Jacoby)**

FIGURE 104

Neobrotica vittatipennis Jacoby, *in* Godman and Salvin, Biologia Centrali-Americana, Coleoptera, vol. 6, pt. 1, p. 577, 1887.

Jacoby had a single specimen of this from Juquila, Mexico, Sallé coll., and this a female. If he had had a male he would probably have realized how unlike *Neobrotica* the species is. The development of the appendages on the front of the head as well as the enlargement of the third antennal joint are unlike that in *Neobrotica* or any species known to me.

Type female, BMNH, from Juquila, Mexico.

Other localities: Mexico: one specimen, Cuernavaca (Bowditch collection), also two specimens in the U.S. National Museum from Cuernavaca collected by N.L.H. Krauss in August 1955; Guadalajara.

Cyclotrypema, new genus

Elongate oblong, the head with a smooth occiput and a median depression over the frontal tubercles, carina short and not prominent, lower front rather bulging but not protuberant; in the male over the labrum a median hole, almost as large as the antennal socket; no trace of this in the female. Antennae reaching the middle of the elytra, filiform, in the male the third joint a little longer than in the female, but in both sexes longer than the fourth joint, remaining joints shorter. Prothorax without a lateral edging, a faint transverse sulcus across the disc, sometimes only a dent on each side. Elytra smooth and flat, without depressions. Epipleura vanishing at apical curve. Anterior coxal cavities open. First tarsal joint of anterior legs inflated and the front tibiae much enlarged at apex. First tarsal joint of hind legs as long as the remaining joints together. Claws appendiculate.

Type species: *Galeruca furcata* Olivier.

Remarks: The name *Cyclotrypema* is derived from the Greek κύκλος, meaning "round," and τρύπημα, meaning "hole."

Cyclotrypema furcata (Olivier)

FIGURE 101

Galeruca furcata Olivier, Entomologie, vol. 6, p. 643, 1808.

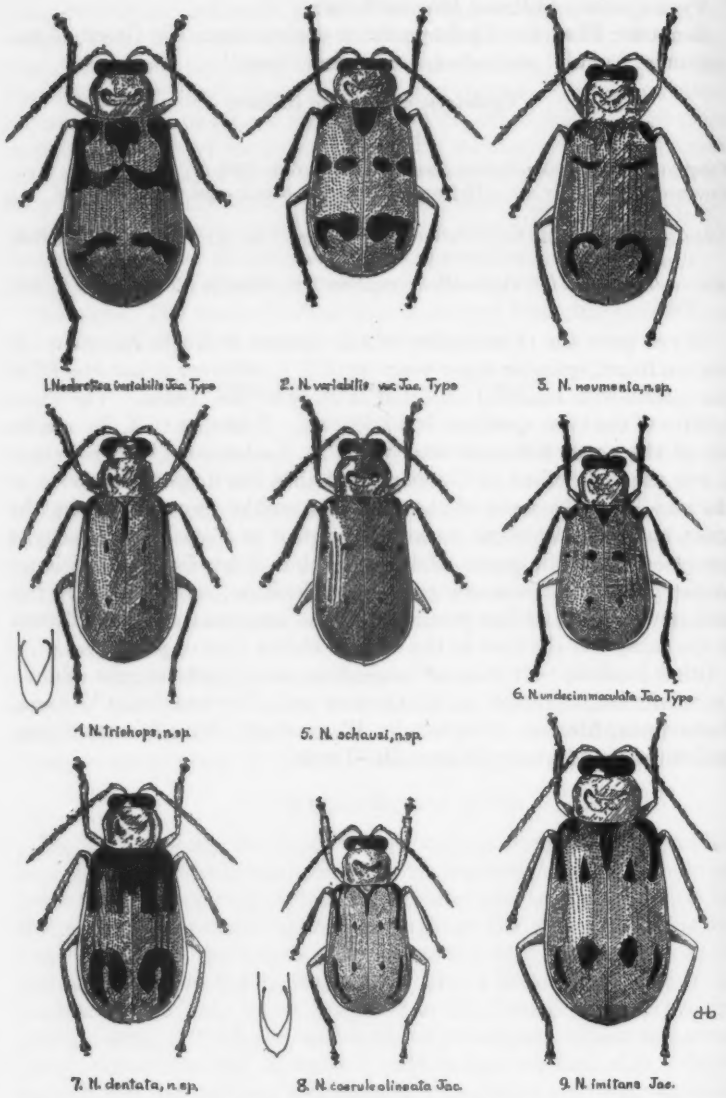
Cerotoma furcata (Olivier).—Dejean, Catalogue de la collection de Coleoptères . . ., ed. 3, p. 403, 1837.

Neobrotica furcata (Olivier).—Schaeffer, Brooklyn Inst. Arts Sci. Mus. Sci. Bull. 1, p. 245, 1906.

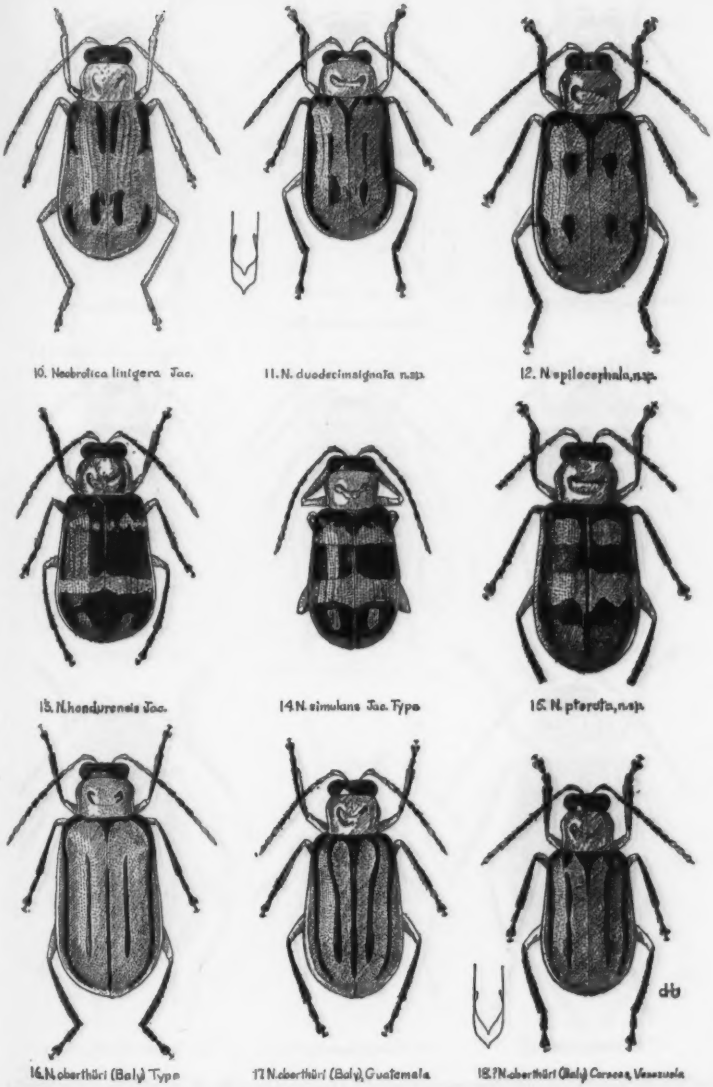
Metrobrotica furcata (Olivier).—Bechyne, Ent. Arb. Mus. G. Frey, vol. 9, p. 596, 1958.

Olivier gave the type locality of this species as North America. It was not found again for many years until E. A. Schwarz at last identified the species with material collected at Brownsville, Texas. The exact locality of the type specimen is not known. Schaeffer took the species out of the genus *Cerotoma* and put it in *Neobrotica*. He wrote that it was not even allied to *Cerotoma*, and that the deep round fovea in the middle of the head of the male was unlike any species that he knew, but for the present he would assign it to *Neobrotica*. Bechyne has placed it in the genus *Metrobrotica*, but it has little resemblance to the genotype, *Cerotoma geometrica* Erichson, except that it has no lateral margin to the pronotum. The antennae are not different in the sexes and the face in the male is unlike that of *geometrica*.

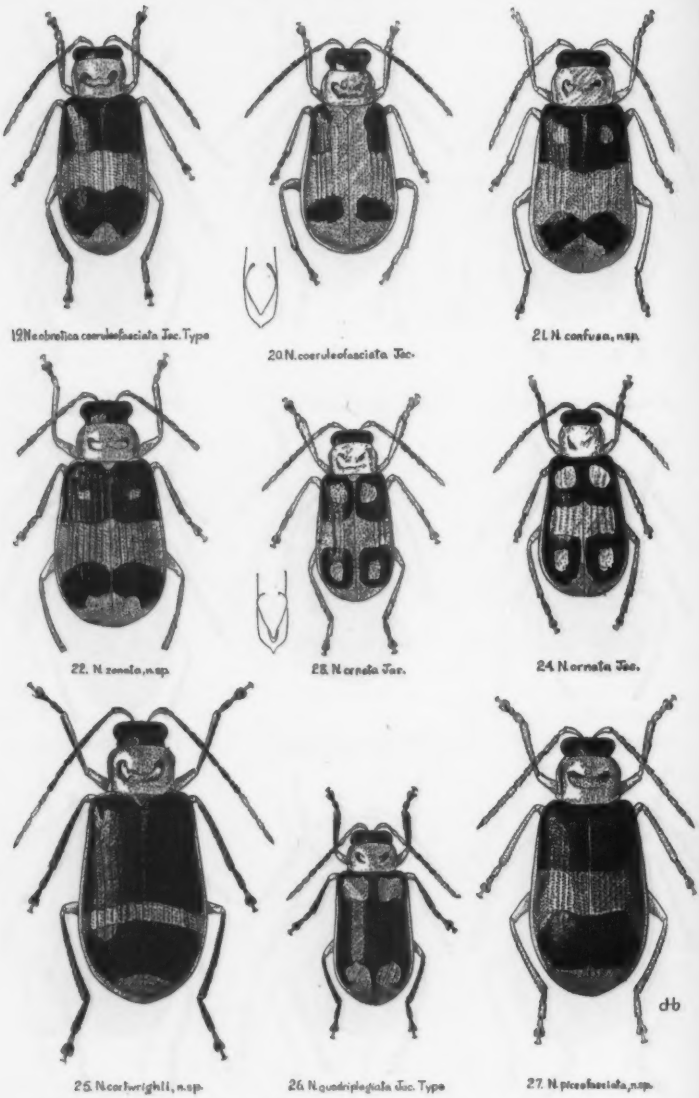
Other localities: El Monte, Tamaulipas, and Montemorelos, Nuevo Leon, Mexico, collected by W. Gertsch and P. Schrammel; Victoria, Tamaulipas, Mexico, collected by W. Gertsch; Russelltown, Texas, on Irish potato leaves; Brownsville, Texas.


1. Neobrotica variabilis Jac. Type
2. N. variabilis var. Jac. Type
3. N. noumenia, n.sp.
4. N. trichops, n.sp.
5. N. schausi, n.sp.
6. N. undecimmaculata Jac. Type
7. N. dentata, n.sp.
8. N. coeruleolineata Jac.
9. N. imitans Jac.
d-b

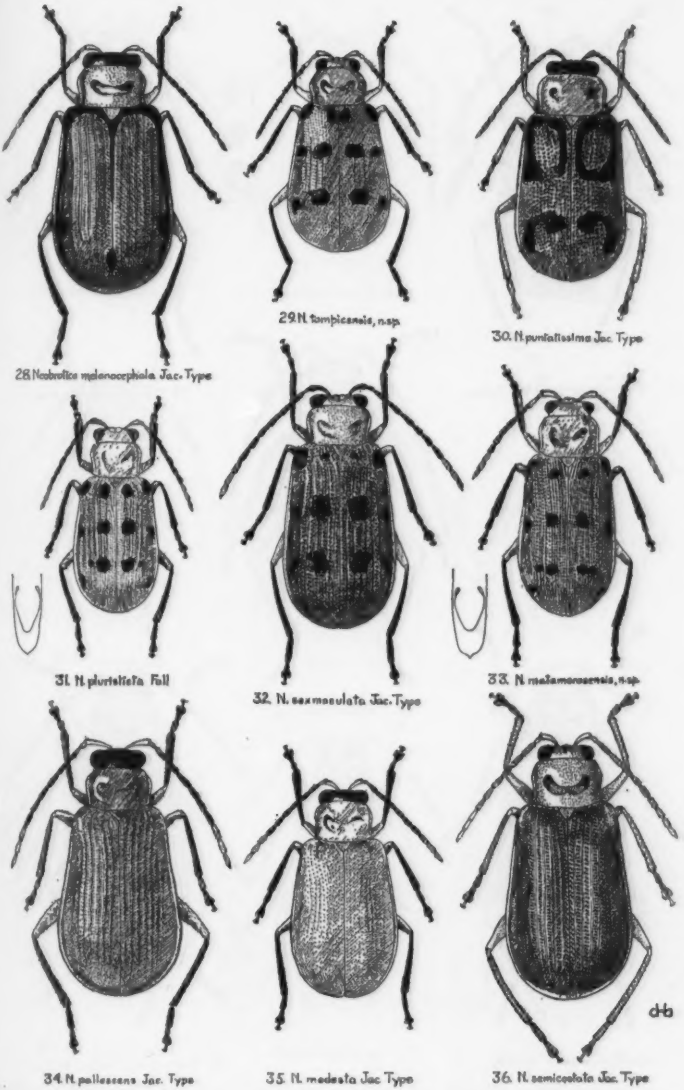
FIGURES 1–9.—1, *Neobrotica variabilis* Jacoby, type; 2, *N. variabilis* var. Jacoby, type; 3, *N. noumenia*, new species; 4, *N. trichops*, new species; 5, *N. schausi*, new species; 6, *N. undecimmaculata* Jacoby, type; 7, *N. dentata*, new species; 8, *N. coeruleolineata* Jacoby; 9, *N. imitans* Jacoby.


10. Neobrotica linigera Jac.
11. N. duodecimsignata n.sp.
12. N. spilocephala, n.sp.
13. N. hondurensis Jac.
14. N. simulans Jac. Type
15. N. pterota, n.sp.
16. N. oberthüri (Baly) Type
17. N. oberthüri (Baly) Guatemala
18. ? N. oberthüri (Baly) Caracas, Venezuela

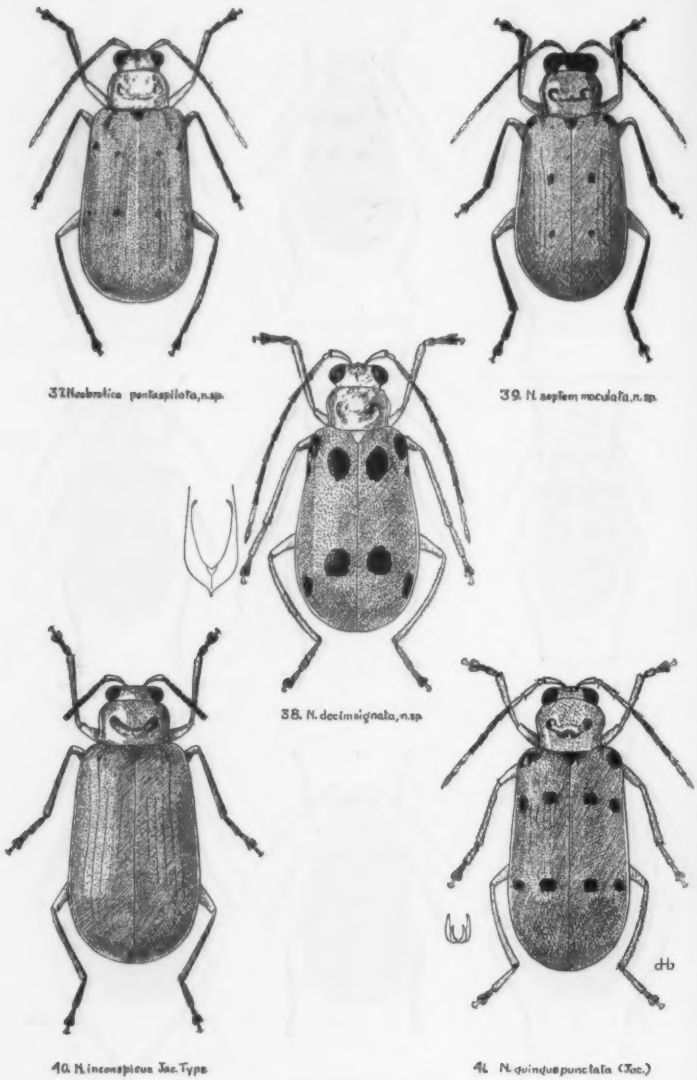
FIGURES 10–18.—10, *Neobrotica linigera* Jacoby; 11, *N. duodecimsignata*, new species; 12, *N. spilocephala*, new species; 13, *N. hondurensis* Jacoby; 14, *N. simulans* Jacoby, type; 15, *N. pterota*, new species; 16, *N. oberthüri* (Baly), type; 17, *N. oberthüri* (Baly), Guatemala; 18, *N. ?oberthüri* (Baly), Caracas, Venezuela.



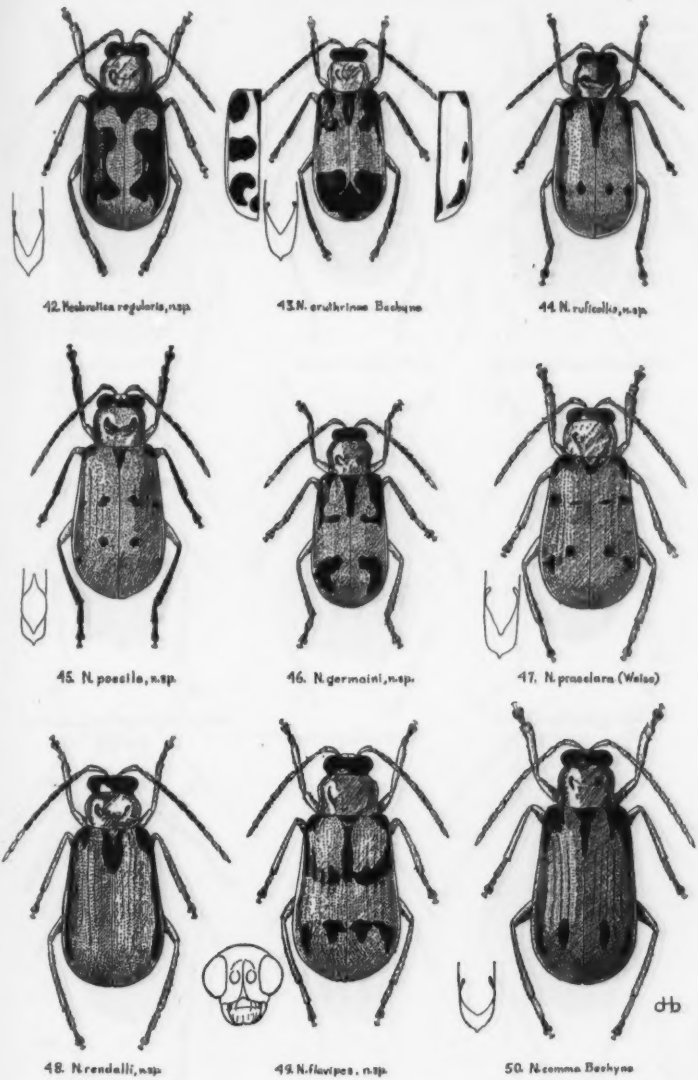
FIGURES 19–27.—19, *Neobrotica coeruleofasciata* Jacoby, type; 20, *N. coeruleofasciata* Jacoby; 21, *N. confusa*, new species; 22, *N. zonata*, new species; 23, *N. ornata* Jacoby; 24, *N. ornata* Jacoby; 25, *N. carterighti*, new species; 26, *N. quadriplagiata* Jacoby, type; 27, *N. piceofasciata*, new species.


28. Neobrotica melanocephala Jac. Type
29. N. tampicensis, n.sp.
30. N. punctatissima Jac. Type
31. N. pluristicta Fall
32. N. sexmaculata Jac. Type
33. N. matamorasensis, n.sp.
34. N. pallescens Jac. Type
35. N. modesta Jac. Type
36. N. semicostata Jac. Type

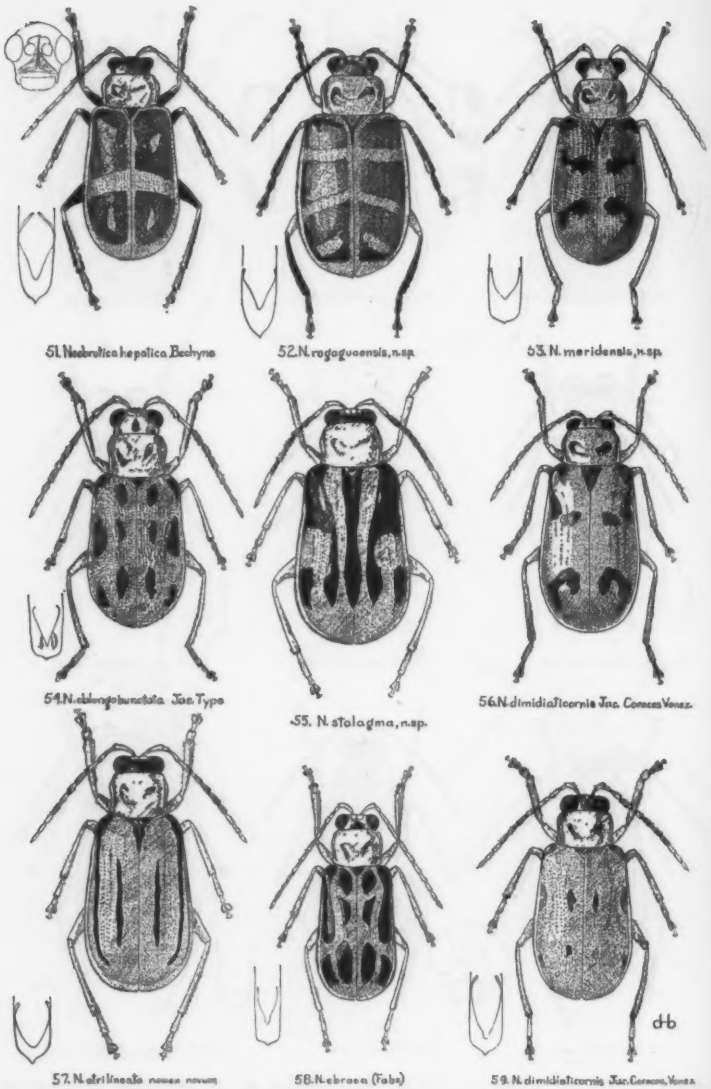
FIGURES 28–36.—28, *Neobrotica melanocephala* Jacoby, type; 29, *N. tampicensis*, new species; 30, *N. punctatissima* Jacoby, type; 31, *N. pluristicta* Fall; 32, *N. sexmaculata* Jacoby, type; 33, *N. matamorasensis*, new species; 34, *N. pallescens* Jacoby, type; 35, *N. modesta* Jacoby, type; 36, *N. semicostata* Jacoby, type.


37. Neobrotica pentaspilota, n.sp.
39. N. septem maculata, n.sp.
38. N. decimsignata, n.sp.
40. N. inconspicua Jac. Type
41. N. quinquepunctata (Jac.)

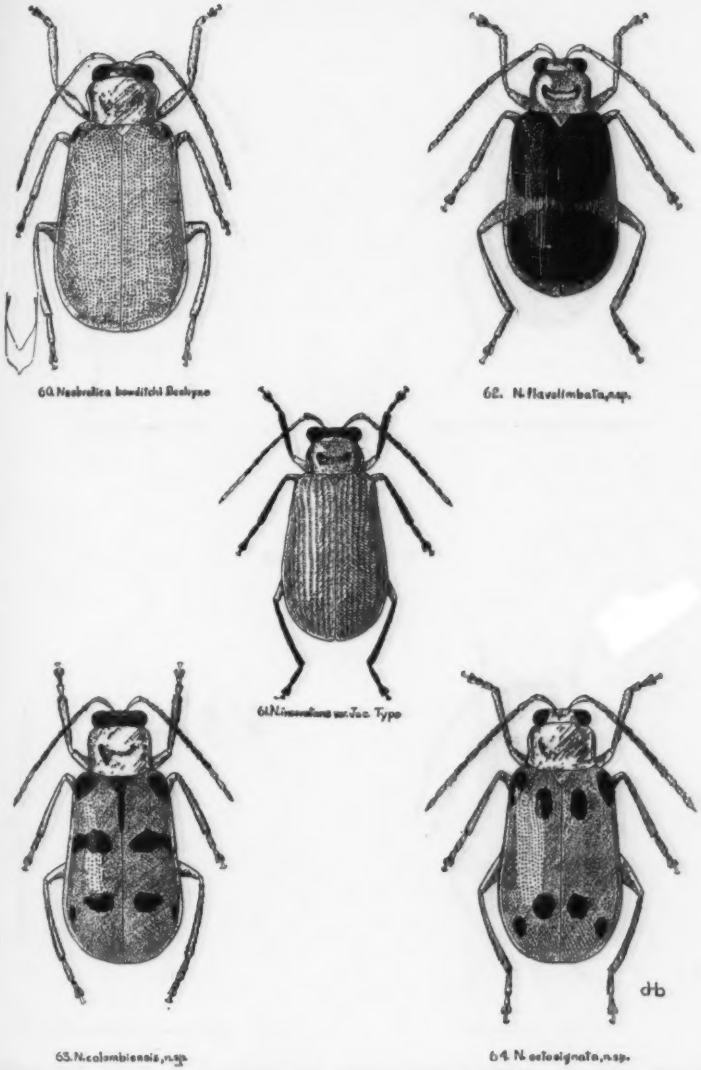
FIGURES 37–41.—37, *Neobrotica pentaspilota*, new species; 38, *N. decimsignata*, new species; 39, *N. septemmaculata*, new species; 40, *N. inconspicua* Jacoby, type; 41, *N. quinquepunctata* (Jacoby).


42. Neobrotica regularis, n.sp.
43. N. erythrinae Bechyne
44. N. ruficollis, n.sp.
45. N. poecila, n.sp.
46. N. germaini, n.sp.
47. N. praeclara (Weise)
48. N. rendalli, n.sp.
49. N. flavipes, n.sp.
50. N. comma Bechyne

FIGURES 42–50.—42, *Neobrotica regularis*, new species; 43, *N. erythrinae* Bechyne; 44, *N. ruficollis*, new species; 45, *N. poecila*, new species; 46, *N. germaini*, new species; 47, *N. praeclara* (Weise); 48, *N. rendalli*, new species; 49, *N. flavipes*, new species; 50, *N. comma* Bechyne.


51. Neobrotica hepatica Bechyne
52. N. rogoguaensis, n.sp.
53. N. meridensis, n.sp.
54. N. oblongopunctata Jac. Type
55. N. stalagma, n.sp.
56. N. dimidiaticornis Jac. Coroas Venez.
57. N. atrilineata nomen novum
58. N. ebraea (Fabr.)
59. N. dimidiaticornis Jac. Caracas, Venez.
db

FIGURES 51–59.—51, *Neobrotica hepatica* Bechyne; 52, *N. rogaguaensis*, new species; 53, *N. meridensis*, new species; 54, *N. oblongopunctata* Jacoby, type; 55, *N. stalagma*, new species; 56, *N. dimidiaticornis* Jacoby, Caracas, Venezuela; 57, *N. atrilineata*, new name; 58, *N. ebraea* (Fabricius); 59, *N. dimidiaticornis* Jacoby, Caracas, Venezuela.

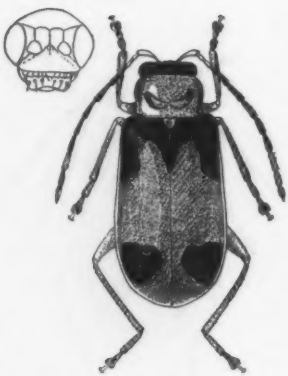


FIGURES 60–64.—60, *Neobrotica bowditchi* Bechyne; 61, *N. inconstans* var. Jacoby, type; 62, *N. flavolimbata*, new species; 63, *N. colombiensis*, new species; 64, *N. octosignata*, new species.

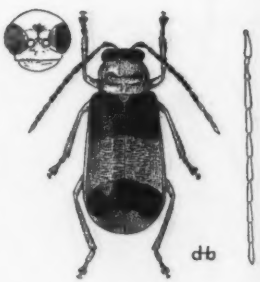
65 Neobrotica quadrimaculata, n.sp.

66. N. grandis, n.sp.

DOUBTFUL SPECIES

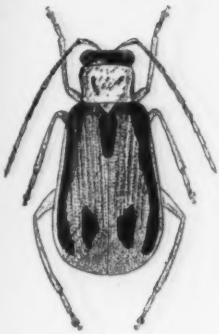


67. N. ludicra Bechyne Type

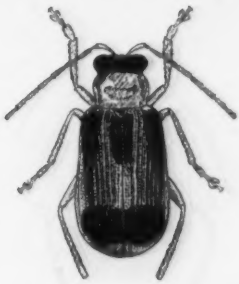


68. N. anisocincta Bechyne Type

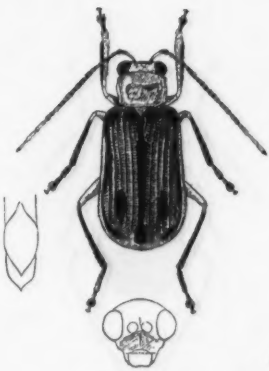
FIGURES 65–68.—65, *Neobrotica quadrimaculata*, new species; 66, *N. grandis*, new species; 67, *N. ludicra* Bechyne, type; 68, *N. anisocincta* Bechyne, type.



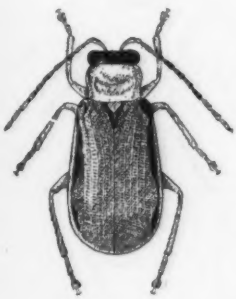
69. Hystiopsis peruensis, n.sp.



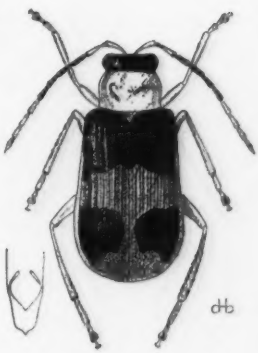
71. H. terminalis, n.sp.



70. H. marginalis (Fabr.)

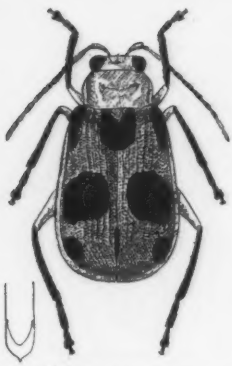


72. H. bryanti, n.sp.



73. H. flavipes, n.sp.

FIGURES 69–73.—69, *Hystiopsis peruensis*, new species; 70, *H. marginalis* (Fabricius); 71, *H. terminalis*, new species; 72, *H. bryanti*, new species; 73, *H. flavipes*, new species.



74. Hystiopsis exarata, n.sp.

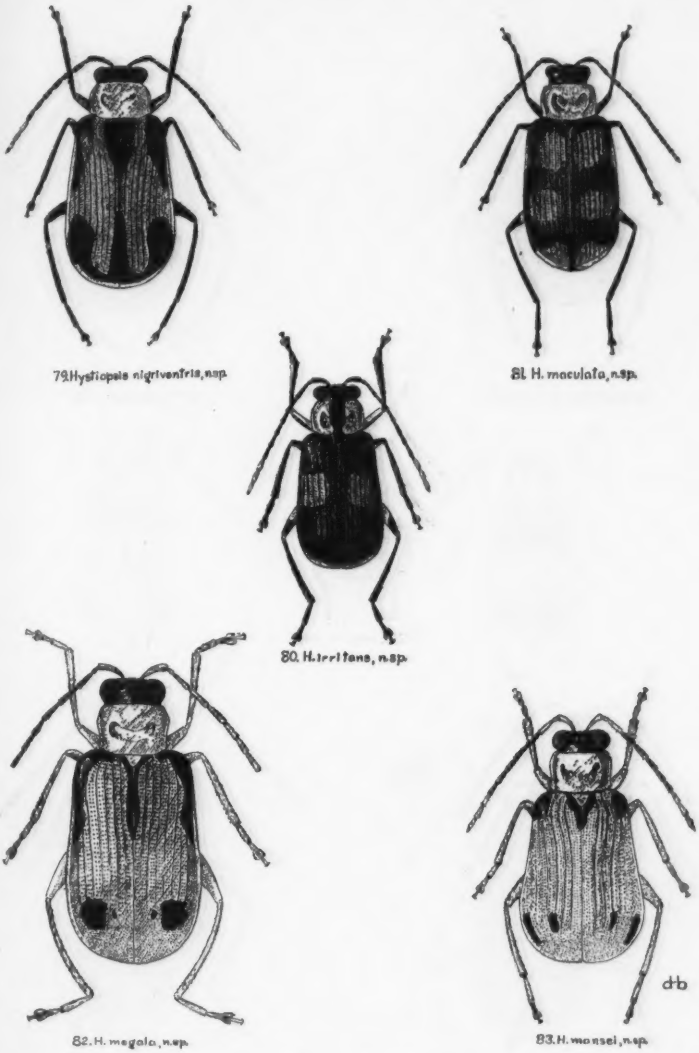
76. H. zonata, n.sp.

75. H. bella, n.sp. Salinas

77. H. bella, n.sp. Loma Alta

78. H. bella, n.sp. Cochabamba, Bolivia

FIGURES 74–78.—74, *Hystiopsis exarata*, new species; 75, *H. bella*, new species, Salinas; 76, *H. zonata*, new species; 77, *H. bella*, new species, Loma Alta; 78, *H. bella*, new species, Cochabamba, Bolivia.



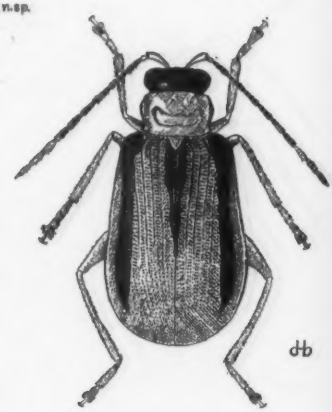
FIGURES 79–83.—79, *Hystiopsis nigriventris*, new species; 80, *H. irritans*, new species; 81, *H. maculata*, new species; 82, *H. megala*, new species; 83, *H. mansei*, new species.

84. Hystiopsis grossa, n.sp.

86. H. beniensis, n.sp.

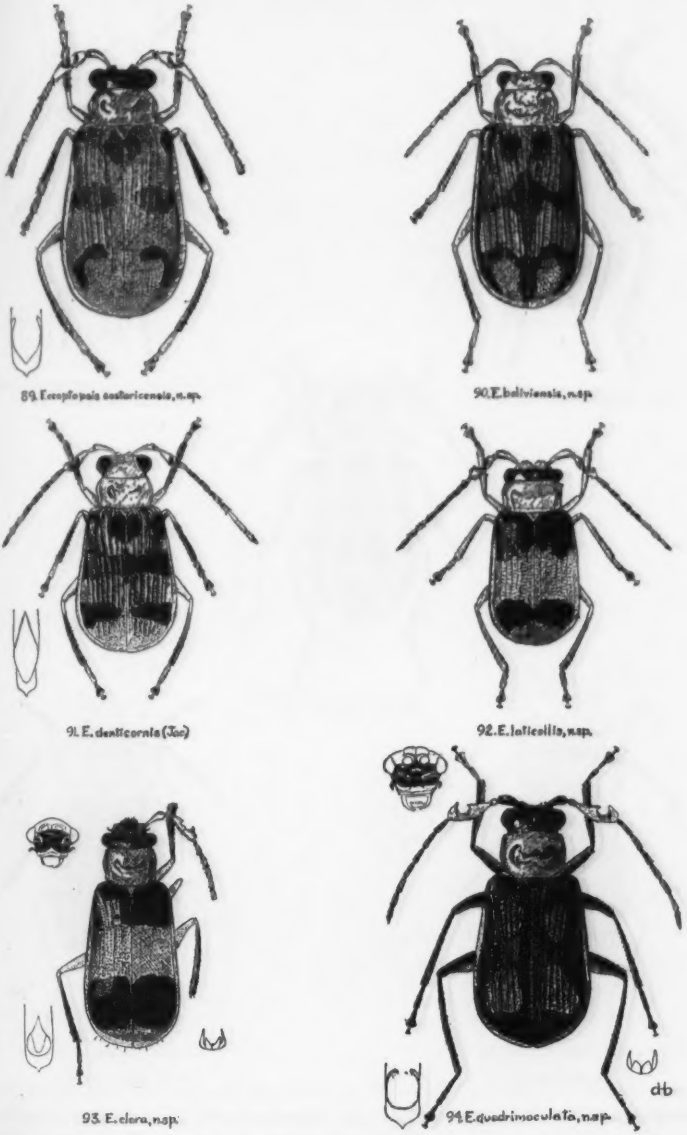
85. H. mapirii, n.sp.

87. H. phaica, n.sp.

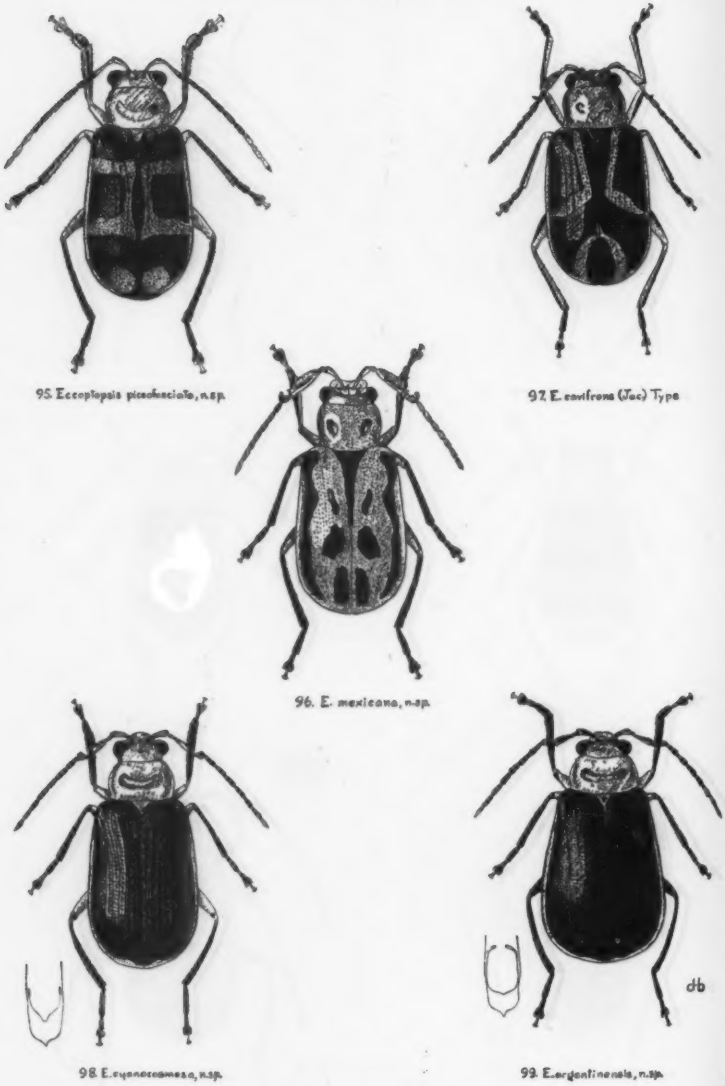


88. H. maxima, n.sp.

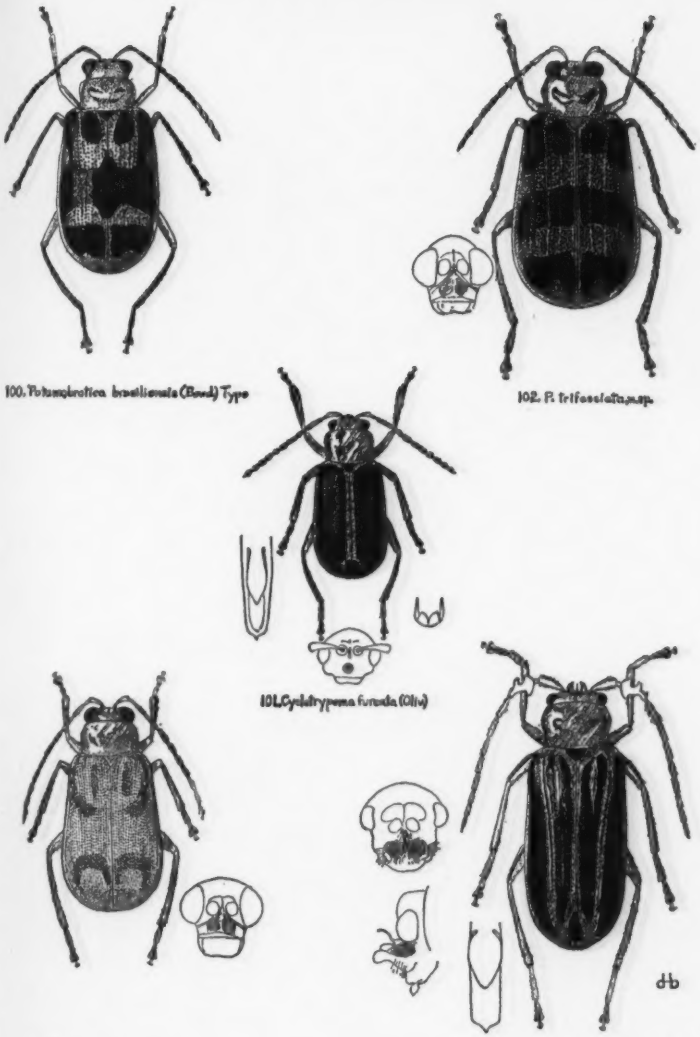
FIGURES 84–88.—84, *Hystiopsis grossa*, new species; 85, *H. mapirii*, new species; 86, *H. beniensis*, new species; 87, *H. phaica*, new species; 88, *H. maxima*, new species.



FIGURES 89–94.—89, *Eccoptopsis costaricensis*, new species; 90, *E. boliviensis*, new species; 91, *E. denticornis* (Jacoby); 92, *E. laticollis*, new species; 93, *E. clara*, new species; 94, *E. quadrimaculata*, new species.



FIGURES 95–99.—95, *Eccoptopsis piceofasciata*, new species; 96, *E. mexicana*, new species; 97, *E. cavifrons* (Jacoby), type; 98, *E. cyanocosmesa*, new species; 99, *E. argentinensis*, new species.



FIGURES 100–104.—100, *Potamobroti cabrasiliensis* (Bowditch), type; 101, *Cyclotrypema furcata* (Oliver); 102, *P. trifasciata*, new species; 103, *P. viridis*, new species; 104, *Rachicephala vittatipennis* (Jacoby).

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NOTES ON CERTAIN NEARCTIC TRICHOPTERA IN THE MUSEUM OF COMPARATIVE ZOOLOGY

By OLIVER S. FLINT, JR.

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Volume 118 1966 Number 3530

NOTES ON CERTAIN NEARCTIC TRICHOPTERA IN THE MUSEUM OF COMPARATIVE ZOOLOGY

By OLIVER S. FLINT, JR.
Associate Curator, Division of Neuropteroids

The collection of Trichoptera in the Museum of Comparative Zoology at Harvard University is one of the most important depositories in the New World of types and other important material. During the summers of 1961 and 1962 it was my good fortune to be able to spend a number of weeks studying and preparing notes and illustrations on some of this material.

Many of the male types of Nearctic caddis flies in this collection were illustrated by Ross (1938b) and most of the other species have been figured or synonymized in later works of the same and other authors. However, there remains a small number of species whose status has never been clarified. In many instances the problem has been that the type is female. Now, with our increasing ability to discriminate between the females of the various species, and with the collection of longer series containing both sexes, it is possible in many cases to associate these female types with the males of the same species. In other cases the uncertainty about the species status has resulted from the failure of the earlier workers to figure or study the cleared, relaxed genitalia of the male types.

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In this paper an attempt is made to elucidate many of these enigmatic species. On occasion the result has been the synonymy with some well-known, adequately figured species, while in other cases it has been necessary to prepare figures for a species not well illustrated by present-day standards. In the genus *Dicosmoecus*, and to a lesser degree in *Leptocella* and *Brachycentrus*, it has been necessary to do a more complete study of all the related species. No attempt is made to give descriptions or complete bibliographies of any of the species. The original description is cited and a subsequent reference is added to an adequate figure whenever one exists, and in a few cases some salient characters are pointed out.

I wish to thank Dr. P. J. Darlington, Jr., and Dr. H. E. Evans for their help during my visits.

Family Psychomyiidae

Phylocentropus carolinus Carpenter

FIGURES 1*a*,*b*

Phylocentropus carolinus Carpenter, 1933, p. 43, fig. 9.

The original figures of this species were prepared from an unrelaxed specimen. The figures here presented were prepared from the cleared, relaxed type.

Family Hydropsychidae

Diplectrona californica Banks

FIGURES 1*d*,*e*

Diplectrona californica Banks, 1914, p. 253, fig. 63.
Diplectrona margarita Denning, 1965, pp. 83–84, figs. 14–15. [New synonymy.]

Because the genitalia of this species have not been well illustrated, figures are given of the unique male type.

Denning recently described *D. margarita* from San Bernardino County, Calif. His figures of the genitalia of *margarita* leave no doubt that it is the same as *californica*.

Aphropsyche doringa (Milne), new combination

Diplectrona doringa Milne, 1936, p. 68.
Aphropsyche aprilis Ross, 1941, p. 79, fig. 60. [New synonymy.]

The male holotype of *doringa* is present in the collection in the Museum of Comparative Zoology rather than lost, as stated by Ross (1944). The type is identical to Ross's figures of *aprilis* and to a male in my collection from North Carolina.

***Hydropsyche carolina* Banks**

FIGURE 1c

Hydropsyche carolina Banks, 1938, p. 77, figs. 8, 9.

The male genitalia of this distinctive little species have not been adequately figured previously. The forewing has a crescentic band of yellowish hair subapically, a patch basally in the anal area, and others at intermediate spots.

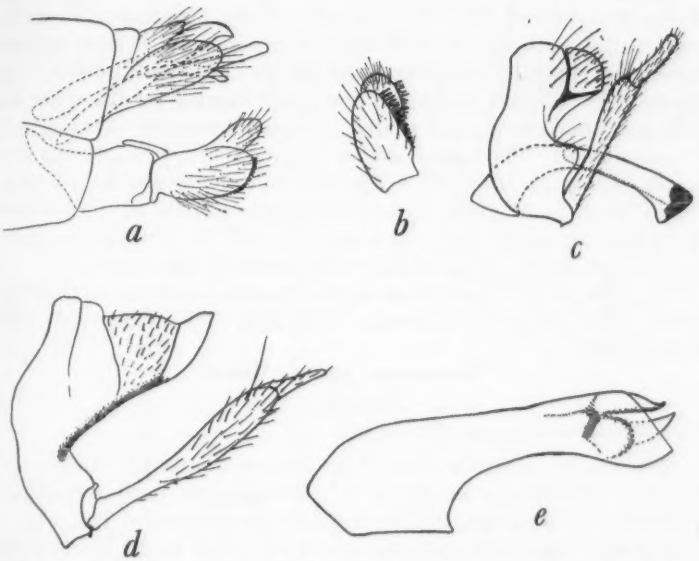

FIGURE 1.—*Phylocentropus carolinus: a*, male genitalia, lateral; *b*, clasper, ventral. *Hydropsyche carolina: c*, male genitalia, lateral. *Diplectrona californica: d*, male genitalia, lateral; *e*, aedeagus, lateral.

Family Limnephilidae

Genus *Dicosmoecus*

The taxonomic situation among the North American species of this genus is still rather confusing, even after studying the types and much more additional material of most of the species. Differences exist between these specimens, especially in the armature of the lateral sheaths of the aedeagus and in the structure of the basal ridge of the clasper. Presently I am able to recognize 5 different kinds of males, based mainly on these structures. Although these 5 genitalic kinds, which are being considered species, do not intergrade in the

material studied, each is somewhat (or sometimes highly) variable, and intergrades may be found in the future.

Dicosmoecus atripes (Hagen)

FIGURES 2*a–f*

Platyphylax atripes Hagen, 1875, p. 600.
Dicosmoecus jucundus Banks, 1943, p. 358, figs. 102, 108, 118. [New synonymy.]
Dicosmoecus nigrescens Banks, 1943, p. 359, figs. 88, 90, 93, 96. [New synonymy.]

This species appears to be the most variable in the genus, especially in the armature of the lateral sheaths of the aedeagus. There is a great variation in the number of spines present and in their arrangement. In general the species may be said to possess sheaths that are round or slightly depressed, generally bearing on the outer side (but sometimes on the inner also) a variable number of rather long, slender spines. The upper end of the basal ridge of the clasper is barely separated from the ridge and not developed into a sharp spine. Figures are given of the lateral penis sheaths of the holotypes of *atripes*, *jucundus*, and *nigrescens*, as well as 3 other specimens, to show the degree of variability encountered in this species.

The types of all three species as well as other males from Colorado, Utah, New Mexico, California, Montana, Wyoming, and Idaho were studied.

Dicosmoecus gilvipes (Hagen)

FIGURES 2*g,h*

Platyphylax gilvipes Hagen, 1875, p. 601.

This is a large species often with the veins strongly marked with fuscous. The lateral sheaths of the aedeagus are quite constant and distinctive in structure. The sheaths are compressed and bear on their upper and lower margins a row of rather short, broad spines which vary greatly in number and exact placement. The basal ridge of the clasper bears a distinct sharp tooth at its upper end.

All the males Banks determined as *D. grandis* Ulmer are this species. However, because the type of *grandis* is female and not in this country, I am not synonymyzing *grandis at* this time. In addition to the type of *gilvipes*, males from California, British Columbia, Nevada, Oregon, and Idaho were seen.

Dicosmoecus pallicornis Banks

FIGURE 2*i*

Dicosmoecus pallicornis Banks, 1943, pp. 359–60, figs. 82, 83, 86, 87.

In coloration this species is paler than the others, and the wings are much more pilose. The lateral sheaths of the aedeagus are distinctive, being short, blunt, and tipped by a cluster of short setae. This species is known only from California.

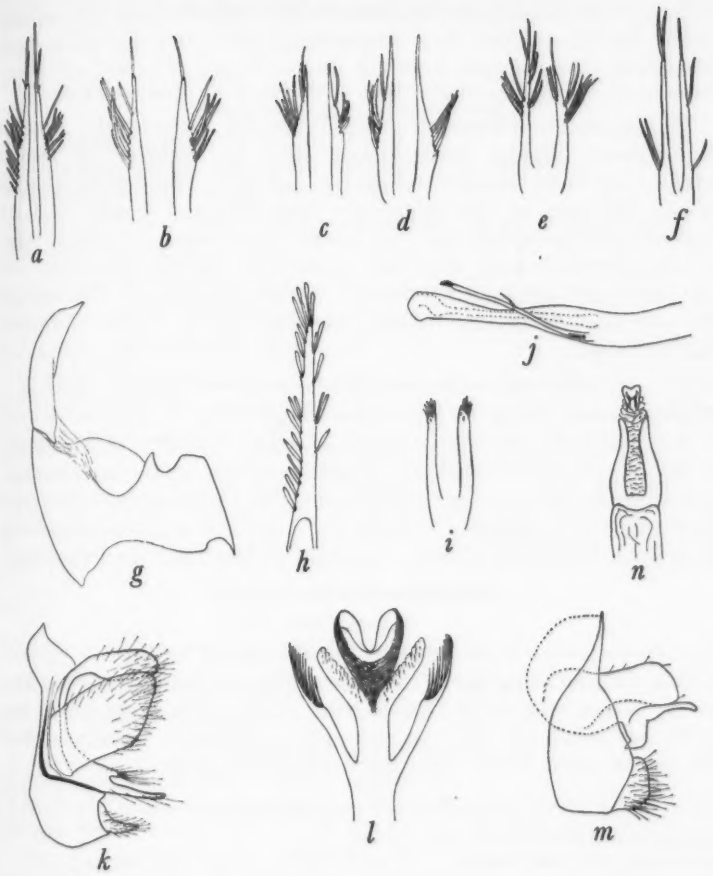

FIGURE 2.—*Dicosmoecus atripes: a*, lateral sheaths of aedeagus of type of *nigrescens*, dorsal; *b*, same of type of *jucundus*, dorsal; *c*, same of type of *atripes*, dorsal; *d*, same of specimen from Modoc Co., Calif., dorsal; *e*, same of specimen from Richel Lodge, Mont., dorsal; *f*, same of specimen from Provo Canyon, Utah, dorsal. *Dicosmoecus gilvipes: g*, clasper of male, dorsal; *h*, lateral sheath of aedeagus, lateral. *Dicosmoecus pallicornis: i*, lateral sheath of aedeagus, dorsal. *Dicosmoecus palatus: j*, aedeagus, lateral. *Allocosmoecus partitus: k*, male genitalia, lateral; *l*, aedeagus, dorsal. *Philocasca antennata: m*, male genitalia, lateral; *n*, aedeagus, dorsal.

***Dicosmoecus palatus* (McLachlan)**

FIGURE 2*j*

Stenophylax palatus McLachlan, 1872, p. 63.
Dicosmoecus obscuripennis Banks, 1938, p. 76, figs. 4, 5. [New synonymy.]

No significant differences could be found between the type of *obscuripennis* Banks from Alaska, and an example of *palatus* McLachlan from the River Kolyma, Siberia. The lateral sheaths of the aedeagus in this species are very long and slender and are capped by a few spines and 1 or 2 nearer the base. The basal ridge of the clasper is long with the upper end slightly separated, but not developed into a sharp tooth. These specimens of this species are a bit smaller than the other species and colored a more uniformly darker brown.

***Dicosmoecus frontalis* (Banks), new combination**

Drusinus frontalis Banks, 1943, pp. 350–351, figs. 28, 29.

The unique female type of this species was studied. The genitalia of the type indicate that the species does not belong in *Drusinus* but in the Dicosmoecinae, most probably in *Dicosmoecus*. *D. aureoventris* Davis is probably a synonym, but until a series containing both sexes becomes available, I hesitate to establish the synonymy.

***Allocosmoecus partitus* Banks**

FIGURES 2*k*,*l*

Allocosmoecus partitus Banks, 1943, pp. 365–366, figs. 73, 74, 76.

This very large caddis fly bears a striking superficial resemblance to the larger species of *Dicosmoecus*. The genitalia, however, are totally different and fully substantiate a separate generic status. The figures were drawn from the unique male type.

***Pseudostenophylax edwardsi* (Banks)**

Anisogamus edwardsi Banks, 1920, p. 345.
Anisogamus atripennis Banks, 1924, pp. 440–441. [New synonymy.]

The abdomens of the female type of *atripennis* and the allotype and another female of *edwardsi* were cleared and studied. No differences could be found between their genitalia, and additionally the two types bear the same data. The type of *atripennis* is larger and more uniformly dark brown than *edwardsi*, but these are apparently only superficial differences.

***Pseudostenophylax sparsus* (Banks)**

Halesus sparsus Banks, 1908a, pp. 63–64, fig. 12.
Stenophylax calypso Banks, 1911, p. 350, fig. 25.
Drusinus virginicus.—Ross (not Banks), 1944, p. 202, fig. 696.

This species is fairly common over most of eastern North America. Ross (1944) published the only good figure of the male genitalia of this

species but unfortunately misidentified it as *virginicus* Banks. The type of the latter is a female of a species of *Pycnopsyche* and is discussed further in that genus.

***Oligophlebodes minuta* (Banks)**

Halesus minutus Banks, 1897, p. 28.
Apatania pictula Banks, 1943, p. 355, figs. 3–6. [New synonymy.]
Oligophlebodes minutus.—Ross, 1944, pp. 283–284, fig. 944.

The abdomen of the male type of *pictula* was cleared and found to be typical of *minuta*.

***Pycnopsyche virginica* (Banks), new combination**

FIGURES 3*a,b*

Potamorites virginicus Banks, 1900, p. 256.

In addition to the female type of this species, I have studied 2 males that agree with the type in coloration, size, and structure. Since the male of this species has not been figured previously, I give figures of this sex here. The species belongs to the *lepida* group of the genus. Only the type of the species from Richmond, Va., a male from Myrtle Beach, S.C. (Oct. 25, 1943, C. T. Parsons), and another male from Faison, N.C. (Oct. 31, 1956, light trap), are known to me.

***Philocasca antennata* (Banks)**

FIGURES 2*m,n*

Stenophylax antennatus Banks, 1900, pp. 254–255.

The unique male type of this species which has not been illustrated previously, is shown here.

***Clostoeca disjuncta* (Banks)**

Anisogamus disjunctus Banks, 1914, p. 156, fig. 22.
Anisogamus disjunctus.—Ross, 1938b, p. 28, fig. 43. [Lectotype designated.]
Clostoeca sperryi Banks, 1943, pp. 352–353, figs. 1, 4, 5. [New synonymy.]

The genitalia of the types of the two species were compared and found to be identical. In coloration *sperryi* is more distinctly marked, probably due to its comparative freshness.

***Psychronia brevipennis* (Banks)**

FIGURES 3*c–e*

Psilopteryx brevipennis Banks, 1904, p. 108, fig. 3.

Figures are given here of the genitalia of the unique female type with the hope that they will permit the recognition of this species.

***Limnephilus sperryi* (Banks)**

FIGURES 3*i,j*

Rhadicoleptus sperryi Banks, 1943, pp. 346–347, figs. 2, 11, 12.

The male type of this species is illustrated here. The first segment

of the foretarsus in this species is twice the length of the second segment.

***Limnephilus costalis* (Banks), new combination**

Asynarchus costalis Banks, 1901, p. 286.
Anisogamus costalis, Ross, 1938b, p. 28, fig. 44. [Lectotype designated.]

This species is related closely to the preceding, and must be transferred to *Limnephilus*. Ross (1938b) illustrated the genitalia of the type of this species.

***Limnephilus concolor* Banks**

FIGURES 3*m*,*n*

Limnephilus concolor Banks, 1899, pp. 207–208.
Limnephilus concolor.—Ross, 1938b, p. 35. [Lectotype designated.]

The lectotype of this species is a female without abdomen, not a male as stated by Ross (1938b). The accompanying figures were prepared from the female lectoparatype. Other specimens of this species have been seen from California and British Colombia, but no collection has contained males. In all probability this is the female of the species generally called *assimilis* Banks, but it might be the female of *L. productus* Banks or *L. diversus* (Banks).

***Limnephilus bifidus* Banks**

FIGURES 3*k*,*l*

Limnephilus bifidus Banks, 1908b, p. 263, fig. 11.
Limnephilus bifidus.—Ross, 1938b, p. 34. [Lectotype designated.]

Figures are presented of the lectotype female of this species in the hope that they will permit its recognition. In coloration the species is marked in the manner of *L. moestus* Banks or *L. sericeus* (Say).

***Limnephilus pallens* (Banks)**

FIGURES 3*f*–*h*

Zaporata pallens Banks, 1920, p. 342, fig. 105.

The accompanying figures were prepared from the male type. The second segment of the foretarsus is about ¾ the length of the first segment, and the eighth tergum is produced into a scabrous lobe mesally. I have seen additional series from Southhampton, Northwest Territory, and Brooks Lake, Alaska.

***Limnephilus sericeus* (Say)**

Phryganea sericea Say, 1824, p. 309.
Anabolia decepta Banks, 1899, pp. 208–209. [New synonymy.]
Limnephilus sericeus.—Ross, 1944, p. 192, figs. 655, 644. [Neotype designated.]

The male type of *decepta* was studied and found to be the same as *sericeus* (Say).

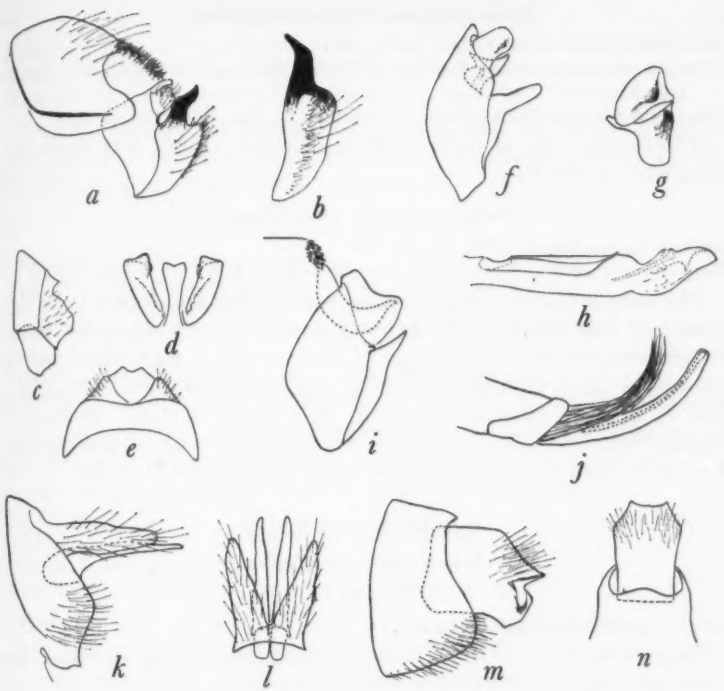

FIGURE 3.—*Pycnopsyche virginica: a*, male genitalia, lateral; *b*, clasper, caudal. *Psychronia brevipennis: c*, female genitalia, lateral; *d*, mesal processes of eighth sternum, ventral; *e*, genitalia, dorsal. *Limnephilus pallens: f*, male genitalia, lateral; *g*, cercus and tenth tergite, caudal; *h*, aedeagus, lateral. *Limnephilus sperryi: i*, male genitalia, lateral; *j*, aedeagus, lateral. *Limnephilus bifidus: k*, female genitalia, lateral; *l*, genitalia, dorsal. *Limnephilus concolor: m*, female genitalia, lateral and slightly caudal; *n*, genitalia, dorsal.

Asynarchus montanus Banks

Asynarchus montanus Banks, 1907, p. 119.
Anabolia curta Banks, 1920, p. 345, fig. 57. [New synonymy.]
Limnephilus curtus.—Ross, 1938b, p. 35. [Lectotype designated.]
Limnephilus montanus.—Ross, 1938b, p. 37. [Lectotype designated.]
Asynarchus curtus.—Schmid, 1954, pp. 81–84, figs. 18, 19.

The female lectotype of *montanus* was studied and found to be the female of the species generally called *curtus* (Banks). Schmid in 1954 synonymized *Limnephilus batchawana* Denning and *L. conerus* Ross with *curtus* Banks, all of which now fall under *montanus* Banks.

***Platycentropus indistinctus* (Walker)**

Limnephilus indistinctus Walker, 1852, p. 37.
Platycentropus indistinctus.—Better and Mosely, 1940, pp. 159–161, fig. 80. [Holotype figured.]
Hylepsyche fraternus Banks, 1943, pp. 349–350, fig. 33. [New synonymy.]

The female type of *fraternus* is inseparable in any way from the female of *indistinctus*.

***Platycentropus amicus* (Hagen)**

Hallesus amicus Hagen, 1861, pp. 265–266.
Platycentropus plectrus Ross, 1938a, pp. 169–170, fig. 111. [New synonymy.]

The unique female type of *amicus* was studied and found to be the female of the species more recently described as *plectrus* by Ross. In addition to the female type of *amicus* and a male paratype of *plectrus*, I have seen the following specimens: Manumuskin, N.J., Oct. 8, 1901, 1 female; Kingston, R.I., Sept. 6, 1907, Barlow, 1 female; Lakehurst, N.J., Aug, 31. 1955, Anderson and Franclemont, 2 females; Sept. 1, 1956, Knowlton and Franclemont, 1 male.

Family Leptoceridae

***Setodes guttatus* (Banks)**

FIGURE 4c

Oecetina guttatus Banks, 1900, p. 257.

Because no figure of the male of this species has been published, the accompanying one of the type was prepared.

***Triaenodes helo* Milne**

FIGURES 4a,b

Triaenodes helo Milne, 1934, p. 12.

The figures were prepared from the unique type of the species which has not been figured previously. The genitalia of the type are badly broken, the dorsal processes of the tenth tergum, the cerci, and the aedeagus are broken off and missing, and the claspers with their attached processes are dissociated from the rest of the capsule. (They are shown in their probable position in the accompanying figure.)

***Athripsodes slossonae* Banks**

Athripsodes slossonae Banks, 1938, p. 77; fig. 7
Athripsodes ophioderus Ross, 1938a, p. 157, fig. 92. [New synonymy.]
Athripsodes daggyi Denning, 1947, p. 254, fig. 6. [New synonymy.]

The type of *slossonae* does not seem to differ significantly from the descriptions of *ophioderus* and *daggyi*. The few examples seen of this species all differ slightly among themselves in the exact contours of the genital parts but agree closely in their general structure, leading to the conclusion that this species is somewhat variable.

***Athripsodes transversus* (Hagen)**

Leptocerus transversus Hagen, 1861, p. 279.
Leptocerus inornatus Banks, 1914, p. 263, fig. 42. [New synonymy.]
Athripsodes transversus.—Ross, 1944, p. 233, fig. 790, 797.

Both the holotype of *inornatus* at the U.S. National Museum and a male paratype at the Museum of Comparative Zoology are unquestionably denuded specimens of *transversus*.

***Leptocella albida* (Walker)**

Leptocerus albidus Walker, 1852, p. 71.
Leptocella coloradensis Banks, 1899, p. 215. [New synonymy.]
Leptocella gracilis Banks, 1904, p. 110. [Preoccupied.]
Leptocella exilis Banks, 1905, p. 19. [New name for *gracilis* Banks 1904. New synonymy.]
Leptocella coloradensis.—Ross, 1938b, p. 22. [Lectotype designated.]
Leptocella albida.—Betten and Mosely, 1940, pp. 61–63, fig. 28. [Holotype figured.]

The types of both *coloradensis* and *exilis* are males, and their genitalia and that of *albida* all seem identical. In coloration both seem well within the variability of *albida* as presently defined.

***Leptocella minuta* Banks**

Leptocella minuta Banks, 1900, p. 257.
Leptocella minuta.—Ross, 1938b, p. 22. [Lectotype designated.]

Although this species is also a probable synonym of *albida*, it is not being synonymized at present because the male allotype lacks its abdomen and shows small colorational differences. The types are slightly smaller than typical of *albida* and bear a few small brownish spots along the veins apically.

***Leptocella texana* Banks**

Leptocella texana Banks, 1905, p. 19.

At some time the species labels in the collection of the Museum of Comparative Zoology for this species and the next became transposed. The labels on the specimens, however, are still correct. This transposition of labels led Ross (1938) to designate a lectotype for *texana* from the syntypic series of *intervena*, clearly an invalid designation.

The unique type of *texana* lacks abdomen but is probably a female. The wings are white but heavily marked with brown along the veins.

***Leptocella intervena* Banks**

Leptocella intervena Banks, 1914, p. 262, figs. 15, 50.
Leptocella texana.—Ross (not Banks), 1938b, p. 23.
Leptocella diarina Ross, 1944, pp. 218–219, figs. 752–760. [New synonymy.]

As mentioned under *texana*, the species labels of this and the preceding were transposed, causing Ross (1938b) to make an invalid lectotype designation for *texana*.

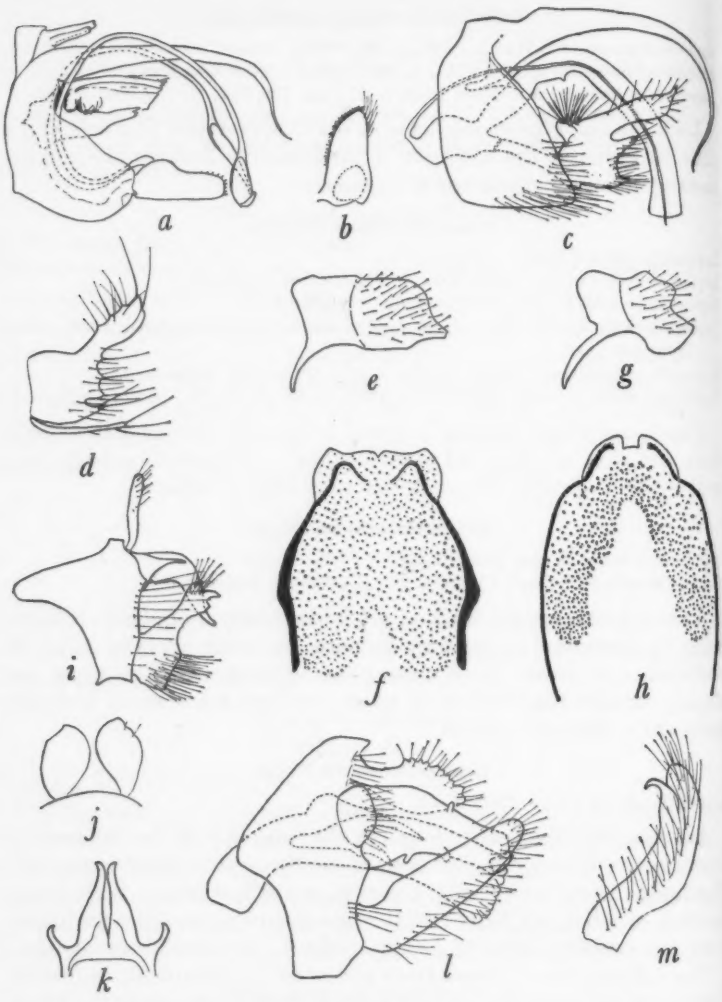

FIGURE 4.—*Triaenodes helo: a*, male genitalia, lateral; *b*, clasper, ventral. *Setodes guttatus: c*, male genitalia, lateral. *Leptocella stigmatica: d*, clasper, lateral. *Brachycentrus incanus: e*, female ninth and tenth terga, lateral; *f*, eighth sternum, ventral. *Brachycentrus nigrisoma: g*, female ninth and tenth terga, lateral; *h*, eighth sternum, ventral. *Oligoplectrum dimicki: i*, male genitalia, lateral; *j*, cerci, anterodorsal; *k*, tenth tergum, dorsal. *Pseudogoera singularis: l*, male genitalia, lateral; *m*, clasper, ventral.

Part of the syntypic series of *intervena* is at the U.S. National Museum, where the type was stated to be placed, and part at the Museum of Comparative Zoology. I am designating here as lectotype a male in the collection of the U.S. National Museum, bearing the following labels: "Zavalla Co., Nueces Riv. IV.26.10 Tx/at light/ Hunter & Pratt Coll/Type No. 18273 U.S.N.M./*Leptocella intervena* Bks. Type [in Banks' writing]/Lectotype *Leptocella intervena* Bks. Designated Flint 1965."

The only difference between the lectotype of *intervena* and a male paratype of *diarina* at the Museum of Comparative Zoology is in the darkness of the V-marks along the posterior margin of the forewing. In *diarina* they are nearly black, in *intervena* mostly brown, a difference I do not think to be of specific value, considering the lack of other characters.

In all likelihood more material will show *intervena* to be a synonym of *texana* and possibly even of *albida*.

Leptocella stigmatica Banks

FIGURE 4*d*

Leptocella stigmatica Banks, 1914, p. 262, fig. 48.
Leptocella stigmatica Ross, 1938b, pp. 22–23. [Lectotype designated.]

This species is recognized easily by its nearly black coloration and the large eyes and shape of the clasper in the male.

Family Brachycentridae

Genus Brachycentrus

The genus *Brachycentrus* in northeastern North America contains at least six species easily recognized in the male sex. In certain species the females are also distinctive, for example, *B. nigrisoma* (Banks), *B. lateralis* (Say), and *B. americanus* (Banks). However, there are three species, *B. incanus* Hagen, *B. numerosus* (Say), and *B. fuliginosus* Walker, in which I am totally unable to differentiate between the females. To compound this difficulty, the types of two of these, *incanus* and *fuliginosus*, are unique females. Because, then, I am unable to obtain conclusive evidence from the types as to which name goes with which species, the names will be applied here as they are recognized in the literature.

Brachycentrus incanus Hagen

FIGURES 4*e,f*

Brachycentrus incanus Hagen, 1861, p. 272.
Brachycentrus incanus.—Denning, 1941, pp. 202–203, fig. 8. [Male allotype designated.]

Figures are here presented of the female type of this species.

There is enough variation in this species and *numerosus* so that all characters which were thought to be distinctive were found to overlap when more material was examined.

I have seen males of this species from the District of Columbia, Maryland, New Jersey, New York, Ontario, Pennsylvania, and Virginia.

***Brachycentrus numerosus* (Say)**

Phryganea numerosa Say, 1823, p. 160.
Brachycentrus numerosus.—Ross, 1944, pp. 264–265, figs. 899, 902. [Neotypes designated.]

Although males of this species and the preceding are easily separated, no differences could be found between the females.

Males of this species from Massachusetts, Michigan, North Carolina, and Quebec were studied.

***Brachycentrus fuliginosus* Walker**

Brachycentrus fuliginosus Walker, 1852, p. 88.
Brachycentrus fuliginosus.—Betten and Mosely, 1940, pp. 177–178, fig. 89. [Holotype figured.]
Brachycentrus fuliginosus.—Leonard and Leonard, 1949, pp. 7–8, figs. 5–8. [Male figured.]

The figures of the female type presented by Betten and Mosely do not show any differences from females of *incanus* or *numerosus*. Figures of a male, presumed to be this species, are to be found in Leonard and Leonard. The species, of which I have seen no examples, is recorded from Michigan, Ontario, and Quebec.

***Brachycentrus lateralis* (Say)**

Phryganea lateralis Say, 1823, p. 161.
Brachycentrus lateralis.—Ross, 1944, pp. 265–266, figs. 900, 903. [Neotypes designated.]

This species appears to have paler legs, antennae, and pilosity than related species. It is possible to separate the females of this species from those of the *incanus* type. In *lateralis* the setal area of the ninth and tenth terga is confined to the apical third, rather than occupying a half or more of the segment.

Males from Illinois, Michigan, Quebec, and Pennsylvania were examined.

***Brachycentrus nigrisoma* (Banks)**

Figures 4*g*,*h*

Sphinctogaster nigrisoma Banks, 1905, p. 12.
Brachycentrus notabulus Milne, 1936, p. 112. [New synonymy.]

The unique female type of this species was studied and found to be identical to the female allotype of *notabulus* Milne. The female sex

is quite distinctive in this species, in the shape of both the ninth and tenth terga and the eighth sternum.

Material from New York and Virginia has been seen.

***Oligoplectrum dimicki* (Milne)**

Figures 4*i-k*

Brachycentrus dimicki Milne, 1936, p. 112.

Because no figures of this species have been published previously, the male type is illustrated here.

Uncertain Placement

***Pseudogoera singularis* Carpenter**

Figures 4*l,m*

Pseudogoera singularis Carpenter, 1933, p. 38, figs. 2, 12.

Additional figures of the male type of this species are presented here. The genitalia show a single dorsal plate flanked by a pair of slightly ventrad plates which have a button-like cercus at their bases. The clasper has a small mesal hook near its apex. This plan of the genitalia seems quite different from that of the Goerinae and it is unlike that of any other taxon with which I am familiar. Several searches at the type locality, Deep Creek near Bryson City, N.C., have failed to turn up any more adult examples or larvae likely to be those of this species.

Pending more information, *P. singularis*, therefore, is retained in the Goerinae, where originally it was placed.

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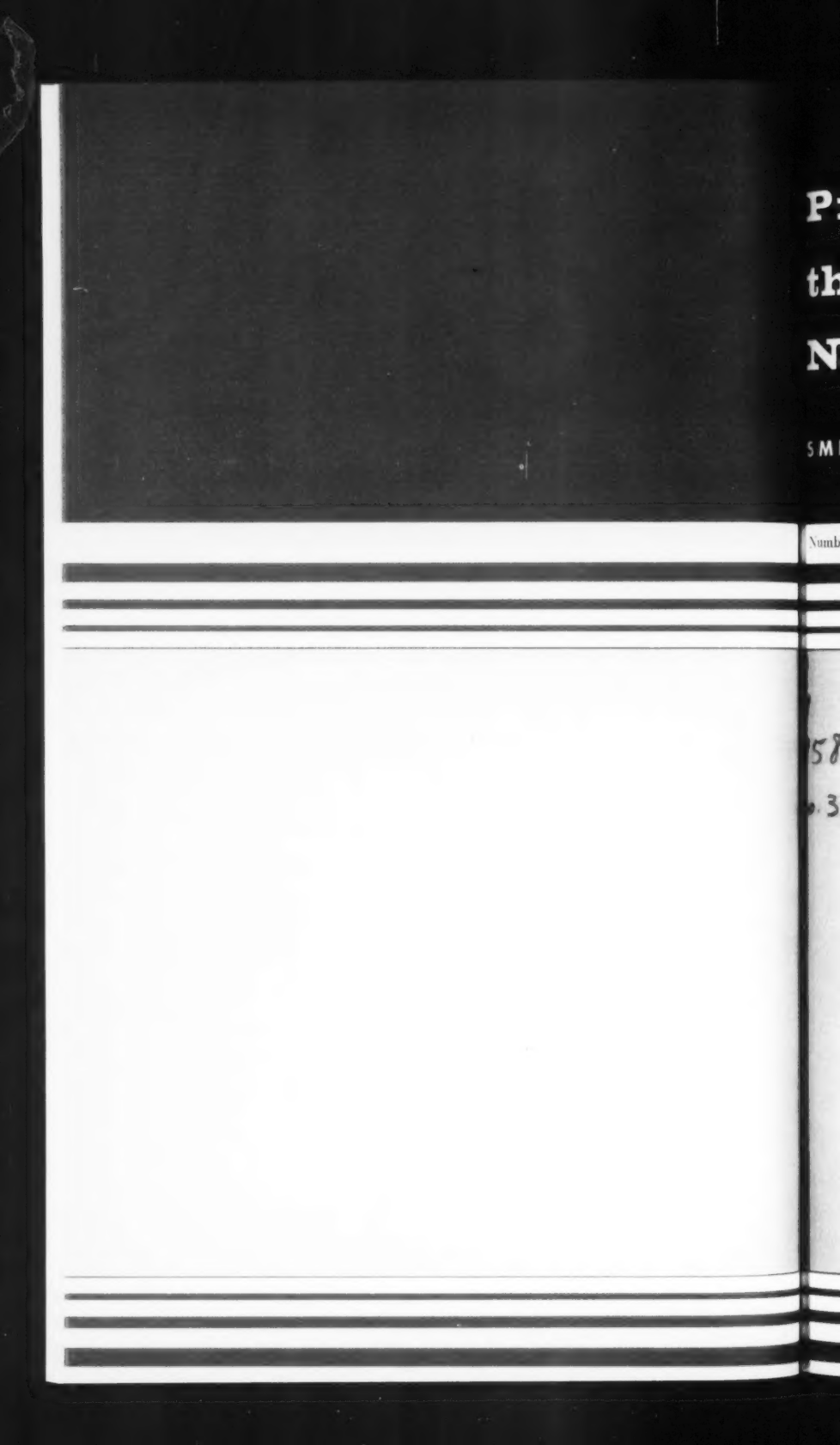

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A REVIEW OF THE GENUS *FALCULINA* WITH DESCRIPTIONS OF NEW SPECIES (LEPIDOPTERA: STENOMIDAE)

By W. DONALD DUCKWORTH

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NEOTROPICAL MICROLEPIDOPTERA, VIII[1]

A REVIEW OF THE GENUS *FALCULINA* WITH DESCRIPTIONS OF NEW SPECIES (LEPIDOPTERA: STENOMIDAE)

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This paper represents part of a continuing study of the Neotropical moths of the family Stenomidae and presents for the first time, since the genus *Falculina* Zeller was established in 1877, illustrations, descriptions, and keys to all the known species. In addition, during the course of the study, two new species were encountered and are described herein.

Although the genus *Falculina* is composed of moderate-sized and rather strikingly marked moths, it is rare in collections. As a result, information concerning distribution is fragmentary and that concerning host plants and biology completely lacking. It is hoped that

[1] Prepared with the aid of a National Science Foundation Grant. Previous parts of this same series are: I and II, Clarke, 1962, Proc. U.S. Nat. Mus., vol. 113, no. 3457, pp. 373–388; III, Clarke, 1964, ibid., vol. 115, no. 3480, pp. 61–84; IV, Duckworth, 1964, ibid., vol. 116, no. 3497, pp. 97–114; V, Obraztsov, 1964, ibid., vol. 116, no. 3501, pp. 183–196; VI, Clarke, 1964, ibid., vol. 116, no. 3502, pp. 197–204; VII, Obraztsov, 1965, ibid., vol. 118, no. 3527, pp. 221–232.

this study will stimulate collectors to provide additional specimens and biological data.

The author wishes to acknowledge with thanks the cooperation and aid of the following persons who have allowed him to study the types and specimens in their charge: Mr. J. D. Bradley of the British Museum (Natural History); Dr. J. G. Franclemont of Cornell University; Dr. H. J. Hannermann of the Institut für Spezielle Zoologie and Zoologisches Museum der Humbolt-Universität zu Berlin; and Dr. Fritz Kasy of the Naturhistorisches Museum, Vienna, Austria.

The author also wishes to thank Mr. Andre Pizzini for the genitalic drawings and distribution maps included in this paper and Mr. Jack Scott for the photographic work.

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History: The genus *Falculina* was described by Zeller (1877) for a new species, *ochricostata*, which he described from a single female specimen. Meyrick (1916) redescribed the genus, added a new species, *lepidota*, and gave a brief description of a male from French Guiana believed by him to be that of *ochricostata*. One year later Meyrick (1917) described a new species, *antitypa*, and reported that this new species was described from the French Guiana material he had mistakenly identified as *ochricostata*. He also states that he is "indebted to Mr. A. Busck for examples of the true *ochricostata* from Panama, distinguishable from *antitypa* by the smaller size, partial rosy tinge of forewings, and especially by having 7 and 8 of the forewings stalked, as Zeller correctly states." Fifteen years later Meyrick (1932) described *F. caustopis* from a single male specimen from Brazil. Busck (1934) listed *Falculina* and the four described species in the Stenomidae part of the Lepidopterorum Catalogus series. Clarke (1955) selected lectotypes and illustrated the genitalia and wings of *antitypa* and *lepidota* in his study of the Meyrick types in the British Museum (Natural History).

Genus *Falculina* Zeller

Falculina Zeller, 1877, Hor. Soc. Ent. Rossica, vol. 13, p. 385.

Type species: *Falculina ochricostata* Zeller, by monotypy.

Head rough, lateral tufts spreading. Labial palpus moderately long, recurved; second segment thickened with appressed scales; apical segment acute, shorter than second. Forewing with costa slightly arched, apex falcate, termen concave, tornus rounded; with 12 veins, 3 and 4 connate, 5 approximate to 3 and 4, 7 and 8 stalked or separate, 7 to termen. Hindwing broader than forewing; with 8 veins, 3 and 4 connate, 5 closely approximate to 3 and 4, 6 and 7

stalked. Abdomen of males with strong, eversible pair of hair pencils contained in an elongate cuplike pocket on first sternum (fig. 1*a*).

Male genitalia: Uncus simple or furcate, erect or strongly recurved; gnathos with separate arms, with or without yokelike connection from their bases; subscaphium present or absent; harpe simple, furcate setae present; anellus with four lateral lobes, ventral pair simple, setiferous, dorsal pair larger, variously shaped; aedeagus with or without long lateral process, entrance of ductus ejaculatorius lateral, cornuti present or absent.

Female genitalia: Ostium bursae sclerotized; ductus bursae membranous; inception of ductus seminalis near ostium; corpus bursae membranous, with a heavily sclerotized, dumbbell-shaped, dentate signum.

This genus is unique in that it is recognized easily by its wing shape and maculation, a situation not common in the stenomids. No other genus in the family has the falcate wing apex and curious wing maculation which Meyrick (1916) referred to as "an aspect of reptilian mimicry." As regards "reptilian mimicry," I have not been able to locate any prior or subsequent application of this term and must simply presume that Meyrick detected a resemblance between the maculation of the moths of this genus and the scaling of reptiles.

The genitalia provide a number of distinguishing characters for the genus. In the males the lateral entrance of the ductus ejaculatorius into the aedeagus plus the separate gnathal arms associated with either a yokelike connection from their bases or a subscaphium on the tuba analis. In the females the inception of the ductus seminalis just before the ostium, membranous ductus bursae, and dumbbell-shaped signum readily distinguish the genus.

Key to the Species of *Falculina* Based on the Genitalia

1. Male 2
   Female 7
2. Subscaphium present 3
   Subscaphium absent 4
3. Uncus truncate apically . . . . . **F. ochricostata** Zeller
   Uncus strongly furcate apically . . . . . **F. kasyi,** new species
4. Ventral edge of harpe clothed with short, heavy setae 5
   Ventral edge of harpe not clothed with short, heavy setae 6
5. Short, heavy setae extending to apex of harpe . . . . . **F. bella,** new species
   Short, heavy setae not extending beyond apical third of ventral margin. **F. lepidota** Meyrick
6. Anellus with one dorsal lobe large, curved laterad, apex irregularly truncate. **F. antitypa** Meyrick
   Anellus with one dorsal lobe large, curved laterad, apex acute. **F. caustopis** Meyrick

7. Lamella antevaginalis reniform . . . . . **F. lepidota** Meyrick
Lamella antevaginalis not reniform 8
8. Posterior margin of lamella antevaginalis broadly notched.
F. kasyi, new species
Posterior margin of lamella antevaginalis narrowly cleft.
F. antitypa Meyrick

Falculina ochricostata Zeller

FIGURES 1*a–d*, 4; PLATE 1 (FIG. 1)

Falculina ochricostata Zeller, 1877, Hor. Soc. Ent. Rossica, vol. 13, p. 385, figs. 135a, b.

Alar expanse 22–28 mm.

Antenna whitish basally, brown beyond. Head whitish shaded laterally with orange; second segment of labial palpus orange on outer side, white on inner side, apical segment white. Legs whitish shaded with orange. Thorax brownish ochreous irregularly spotted with fuscous. Forewing with veins 7 and 8 stalked; brownish ochreous becoming whitish towards costa basally; costa orange; basal half of wing more or less irregularly spotted with fuscous including two round fuscous spots enclosed by a ring of ground color at basal third; a line of indistinct fuscous dots from middle of costa to near termen beneath apex then sharply angulated and sinuate to dorsum before tornus; a terminal series of fuscous dots from apex to tornus. Cilia brownish. Hindwing stramineous basally deepening to bright yellow apically; cilia whitish.

Male genitalia: See figures (slide W.D.D. 2632). Uncus erect, truncate apically; gnathos two separate spiny arms; subscaphium present, bearing small spines apically; harpe of approximately uniform width throughout, apical third recurved approximately 45°; anellus with four lateral lobes, ventral pair small, setiferous humps, dorsal pair curved slightly laterad, bladelike in shape, apically acute; aedeagus simple, vesica without cornuti.

Female genitalia: Unknown.

Type: In the Zoologisches Museum der Humboldt-Universität zu Berlin.

Type locality: Unknown.

Distribution: Panama: Trinidad River (June, Sept.); La Chorrera (May). Costa Rica: Tuis [no date].

I have examined Zeller's type, a single female without abdomen, and associated it with material from Central America collected by Busck and identified by him as *ochricostata*. Zeller described *ochricostata* from material in the Staudinger Museum and, although Zeller's type is without locality data, the fact that most of the species described in the same paper were collected in Central America by

H. Ribbe, who was at that time curator of the Staudinger Museum, lends considerable support to the association with Busck's material.

On the basis of external characters such as maculation, venation, etc., *ochricostata* is inseparable from *kasyi*. However, the genitalia afford abundant distinguishing characters of which the truncate uncus in the males of *ochricostata* as compared to strongly furcate uncus in *kasyi* is the most prominent. Since the only known female of *ochricostata*, the type, is without abdomen no distinguishing characters for the females can at present be given.

***Falculina kasyi*, new species**

FIGURES 2*a*, 3*b*, 4; PLATE 1 (FIG. 2)

Alar expanse 26–28 mm.

Antenna, head, legs, thorax, forewing, and hindwing as in *ochricostata*.

Male genitalia: See figures (slide W.D.D. 2525, type). Uncus erect, strongly furcate apically; gnathos two separate arms, recurved and spatulate apically; subscaphium present, without apical spines; harpe broad, basally narrowing near midpoint; anellus with four lateral lobes, the ventral pair very slight setiferous elevations, the dorsal pair broad basally, excavated sharply near apex forming recurved, flat lobes; aedeagus simple, vesica without cornuti.

Female genitalia: See figures (slide A. Busck 1001, paratype). Posterior margin of lamella antevaginalis broadly notched; ostium bursae pouchlike; ductus bursae membranous.

Type: Moengo, Boven, Cottica R., Surinam. USNM 67227.

Distribution: Surinam: Moengo, Boven, Cottica R. (May); Kwakoegron, Saramacca R. (June). French Guiana: Saint Jean, Maroni R. [no date]. Brazil: Ponte Nova, Rio Xingu [no date].

Described from the male holotype, May 14, 1927, Moengo, Boven, Cottica R., Surinam; two male paratypes (Wm. Schaus), Saint Jean, Maroni, R., French Guiana, June 9, 1927, June 11, 1927, Kwakoegron, Saramacca R., Surinam; and one female paratype (Dognin Coll.), Ponte Nova, Rio Xingu, Amazonas.

This species is related very closely to *ochricostata* and characters for separation of the males were given in the discussion of that species. The broadly notched posterior margin of the lamella antevaginalis in the female genitalia readily separates *kasyi* from the other known females of *Falculina*.

I take great pleasure in naming this species in honor of Dr. Fritz Kasy, distinguished lepidopterist at the Naturhistorisches Museum, Vienna, Austria, who has been of invaluable aid in my study of the family Stenomidae.

Falculina antitypa Meyrick

FIGURES 2*b*, 3*a*, 4; PLATE 1 (FIG. 3)

Falculina antitypa Meyrick, 1917, Exotic Microlepidoptera, vol. 2, p. 58.

Alar expanse 24–36 mm.

Antenna white basally, brown beyond. Head whitish ochreous, shaded slightly with ochreous laterally; second segment of labial palpus grayish on outer side, white on inner side, apical segment white. Legs whitish, slightly shaded with fuscous. Thorax as in *ochricostata*. Forewing as in *ochricostata* except veins 7 and 8 separate. Hindwing as in *ochricostata*.

Male genitalia: See figures (slide W.D.D. 2640). Uncus curved approximately 90° ventrad at midpoint; gnathos consisting of two separate, apically acute arms with yokelike ventral connection from their bases; subscaphium absent; harpe narrow, slightly curved, apically acute; anellus with four lateral lobes, the ventral pair short, setiferous, the dorsal pair asymmetrical, one apically acute, bladelike, the other long, curved, trumpet-like, apex irregularly truncate; aedeagus with a long, curved, lateral process, vesica clothed apically with small spines.

Female genitalia: See figures (slide W.D.D. 3063). Posterior margin of lamella antevaginalis narrowly cleft; ostium bursae with two heavily sclerotized, pouchlike areas; ductus bursae long, membranous.

Type: In the British Museum (Natural History).

Type locality: Rio Maroni, French Guiana.

Distribution: French Guiana: Rio Maroni [no date].

I have examined specimens from Meyrick's original series and the photograph of the type specimen given in Clarke (1955). This species is very distinct on the basis of characters of the genitalia. The long trumpet-like anellar lobe in the male genitalia and the narrowly cleft posterior margin of the lamella antevaginalis in the female genitalia readily separates *antitypa* from the other species of *Falculina*.

Falculina caustopis Meyrick

FIGURES 2*c*, 5; PLATE 1 (FIG. 4)

Falculina caustopis Meyrick, 1932, Exotic Microlepidoptera, vol. 4, p. 288.

Alar expanse 29 mm.

Antenna whitish, shaded with gray basally, fuscous beyond. Head grayish white, shaded laterally with orange; second segment of labial palpus orange, shaded with fuscous on outer side, white on inner side, apical segment white, slightly shaded with fuscous at apex. Legs whitish, foreleg heavily shaded with fuscous. Thorax brown, shaded with fuscous. Forewing with veins 7 and 8 closely approximated at base; brown with faint pinkish tinge; basal half of wing mottled with

fuscous scales; costal edge fulvous; a faint fuscous subterminal line from middle of costa to near termen beneath apex, then sharply angulated and sinuate to dorsum before tornus; a terminal series of fuscous dots. Cilia concolorus with ground color. Hindwing bright yellow basally, apical fourth fuscous; cilia fuscous.

Male genitalia: See figures (slide W.D.D. 3125, type). Uncus erect, rounded apically; gnathos as in *antilypa;* subscaphium absent; harpe narrow, slightly curved, bluntly pointed apically; anellus with four lateral lobes, ventral pair simple, setiferous, dorsal pair asymmetrical, one long, curved 90° laterad near apex, inner margin serrate at apical third, apex acute, other shorter, slightly curved laterad, apically acute; aedeagus with a thin, straight lateral process, vesica clothed with tiny spines.

Female genitalia: Unknown.

Type: In the Naturhistorisches Museum, Vienna, Austria.

Type locality: Teffé, Amazonas, Brazil.

Distribution: Brazil: Teffé, Amazonas [no date].

Through the courtesy of Dr. Fritz Kasy, Naturhistorisches Museum, Vienna, I have had the opportunity to study Meyrick's type specimen which is the only known example of this species. The fuscous margin on the hindwing and the large, hooked lateral process of the aedeagus in the male genitalia readily distinguish *caustopis*.

Falculina lepidota Meyrick

FIGURES 2*d*, 3*f*, 5; PLATE 1 (FIG. 5)

Falculina lepidota Meyrick, 1916, Exotic Microlepidoptera, vol. 1, p. 482.

Alar expanse 28–36 mm.

Antenna whitish basally, brown beyond. Head whitish, shaded laterally with yellow; second segment of labial palpus whitish, shaded with yellow ochreous on outer side, white on inner side, apical segment white. Legs whitish ochreous, shaded with brown. Thorax as in *caustopis*. Forewing with veins 7 and 8 separate; maculation as in *caustopis*. Hindwing in female grayish basally, yellow apically; in male fuscous tinged with yellow ochreous at apex; cilia whitish ochreous in female, grayish ochreous in male.

Male genitalia: See figures (slide W.D.D. 2641). Uncus short, curved ventrad, apically acute; gnathos two separate truncate arms with yokelike ventral connection from their bases; subscaphium absent; harpe broad basally, ventral edge clothed in short, heavy setae from basal third to apical third; anellus with four lateral lobes, ventral pair simple, setiferous, dorsal pair asymmetrical, one longer, apically acute, bladelike, other shorter, twisted, apically rounded; aedeagus with a long, recurved lateral process, vesica clothed with tiny spines.

Female genitalia: See figures (slide W.D.D. 3064). Lamella antevaginalis reniform; ostium bursae simple; ductus bursae long, membranous.

Type: In the British Museum (Natural History).

Type locality: Rio Maroni, French Guiana.

Distribution. French Guiana: Rio Maroni [no date].

This species is very closely related to *bella* new species; however, the long, recurved, lateral aedeagal process and the short, heavy setae on the ventral edge of the harpe not extending to the apex readily separates the males. Since the female of *bella*, new species is not known, it is at present impossible to compare the females. However, the reniform lamella antevaginalis in the female genitalia distinguishes *lepidota* from the other known females in the genus.

***Falculina bella*, new species**

FIGURES 2*e*, 5; Plate 1 (FIG. 6)

Alar expanse 28 mm.

Antenna whitish. Head whitish, slightly shaded laterally with ochreous; second segment of labial palpus white, slightly shaded with ochreous on outer side, white on inner side, apical segment white. Legs whitish, foreleg shaded with brown. Thorax as in *ochricostata*. Forewing with veins 7 and 8 separate; maculation as in *ochricostata*. Hindwing as in *ochricostata*.

Male genitalia: See figures (slide W.D.D. 3060, type). Uncus short, recurved, blunt apically; gnathos two separate apically acute arms, dorsal margin at apex serrate, with yokelike ventral connection from their bases; subscaphium absent; harpe broad basally, ventral edge clothed in short, heavy setae from basal third to apex; anellus with four lateral lobes, ventral pair simple, setiferous, dorsal pair asymmetrical, one longer, apically acute, bladelike, the other short, broad, flaplike; aedeagus with a long, curved lateral process, vesica clothed with tiny spines.

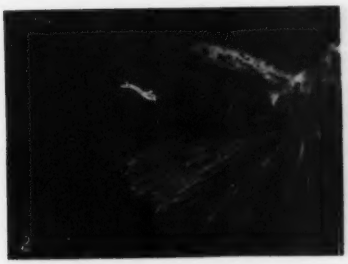
Female genitalia: Unknown.

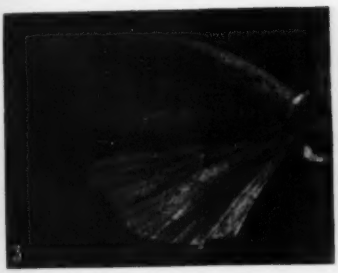
Type: Above Obidos, Amazon, Brazil. USNM 67228.

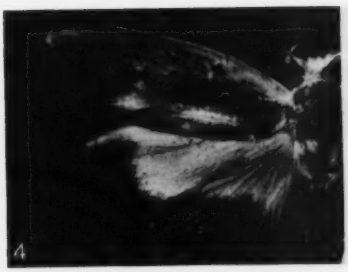
Distribution: Brazil: above Obidos (Sept.).

Described from the male holotype, Sept. 10, 1920, above Obidos, Amazon, Brazil.

This species is related very closely to *lepidota* and a comparison of distinguishing characters has been included in the discussion of that species.







Left wings: 1, *Falculina ochricostata* Zeller; 2, *F. kasyi*, new species; 3, *F. antitypa* Meyrick; 4, *F. caustopis* Meyrick; 5, *F. lepidota* Meyrick; 6, *F. bella*, new species.

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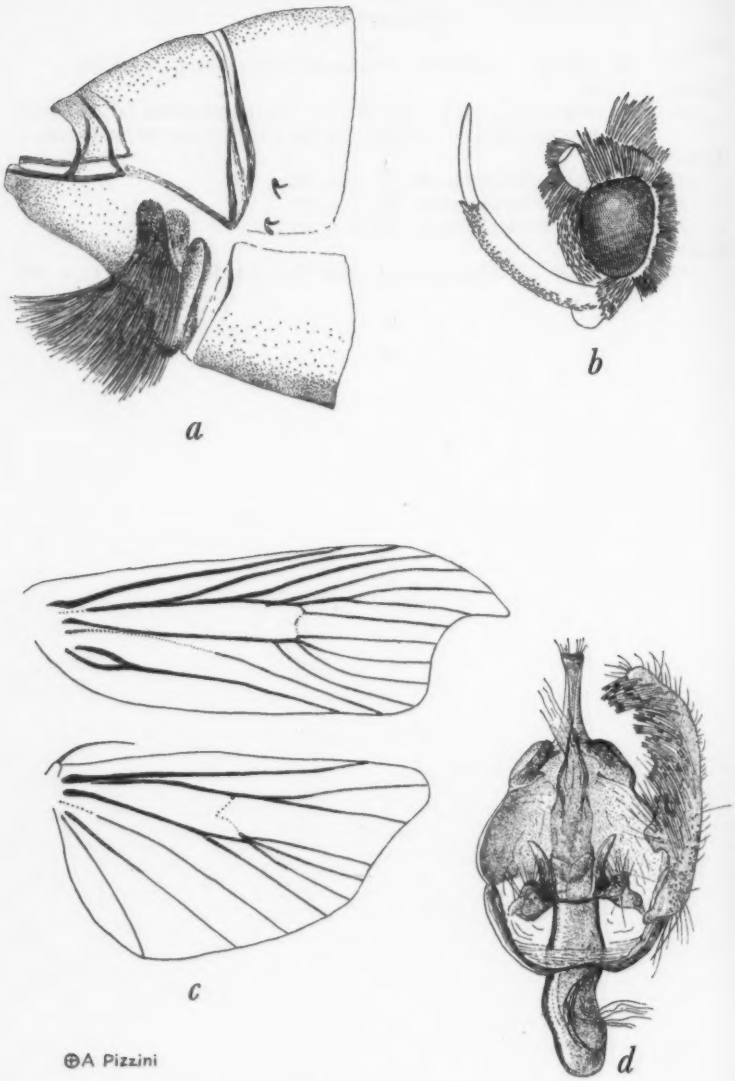

FIGURE 1.—*Falculina ochricostata* Zeller: *a*, lateral view of abdominal segments 1–2; *b*, lateral view of head; *c*, wing venation; *d*, ventral view of male genitalia with left harpe removed.

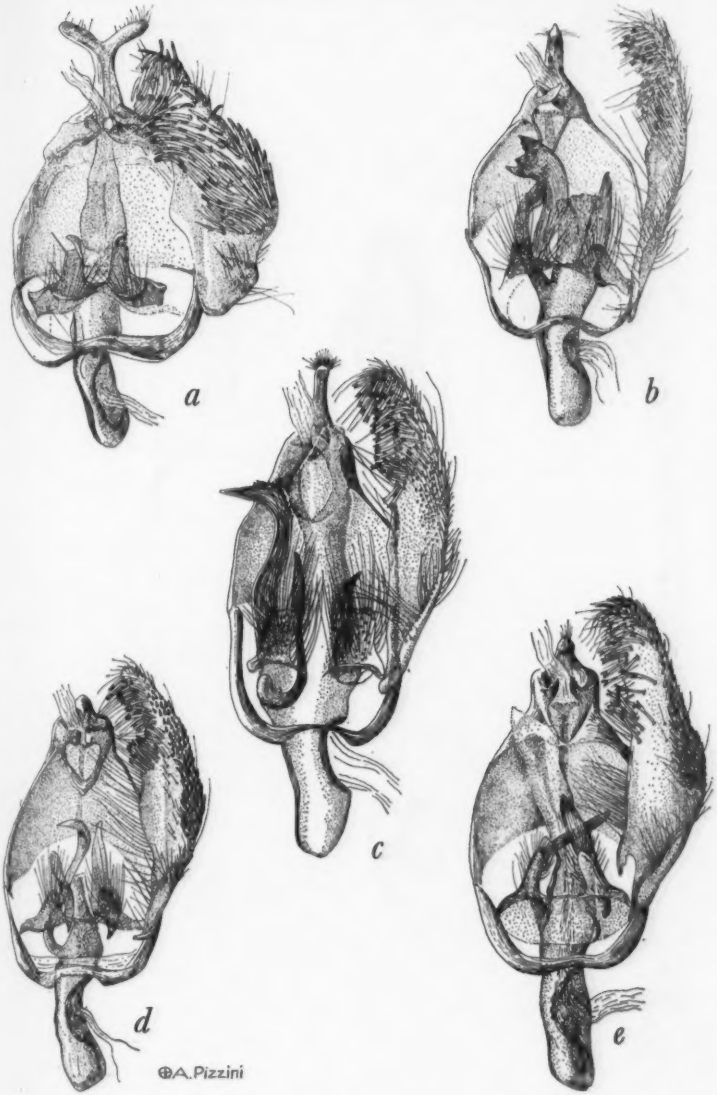

FIGURE 2.—Ventral view of male genitalia with left harpe removed: *a*, *Falculina kasyi*, new species; *b*, *F. antitypa* Meyrick; *c*, *F. caustopis* Meyrick; *d*, *F. lepidota* Meyrick; *e*, *F. bella*, new species.

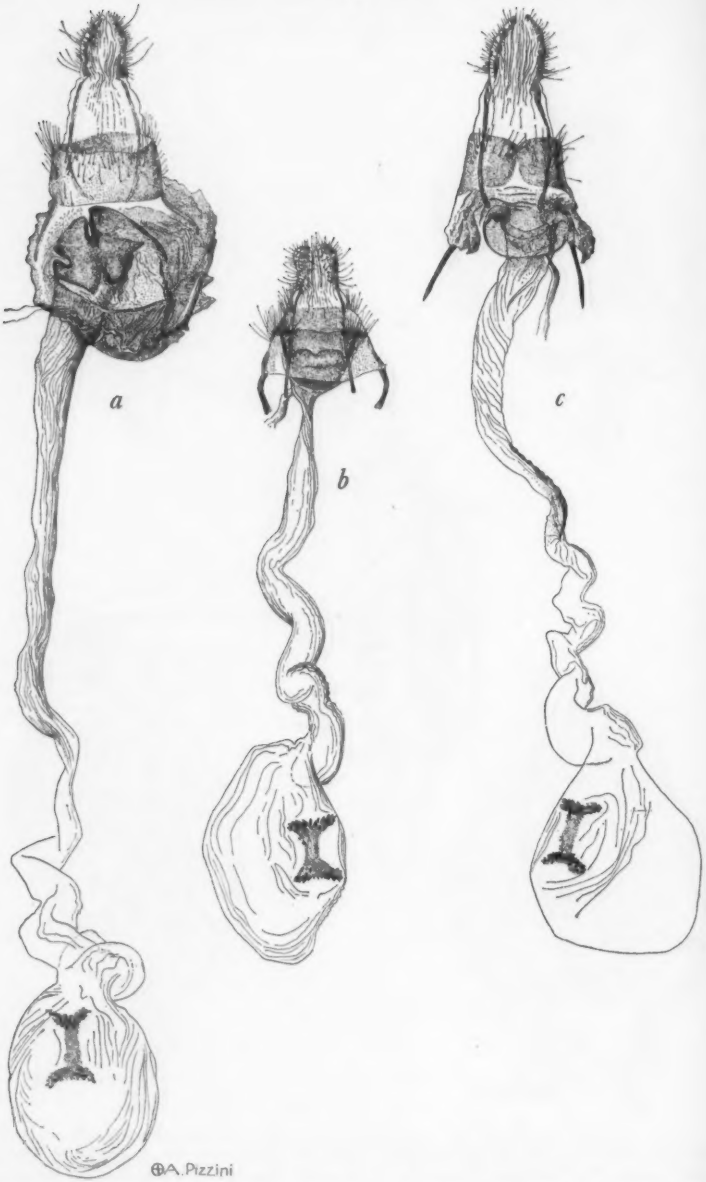

FIGURE 3.—Ventral view of female genitalia: *a*, *Falculina antitypa* Meyrick; *b*, *F. kasyi*, new species; *c*, *F. lepidota* Meyrick.

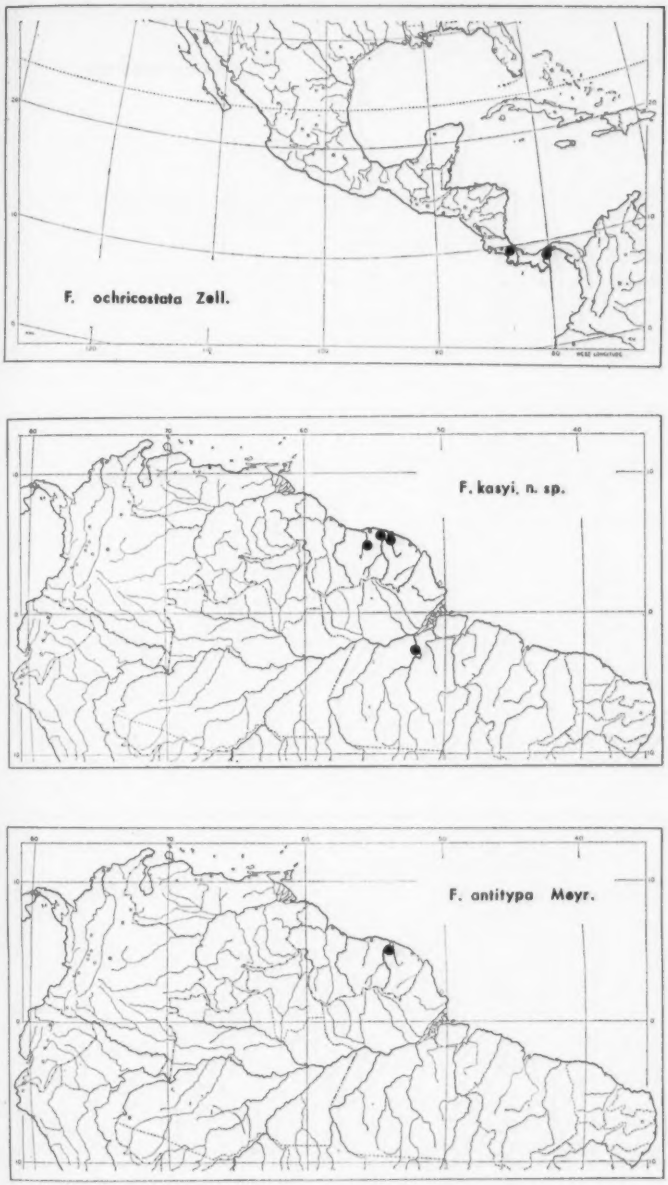

FIGURE 4.—Distribution of species of *Falculina*.

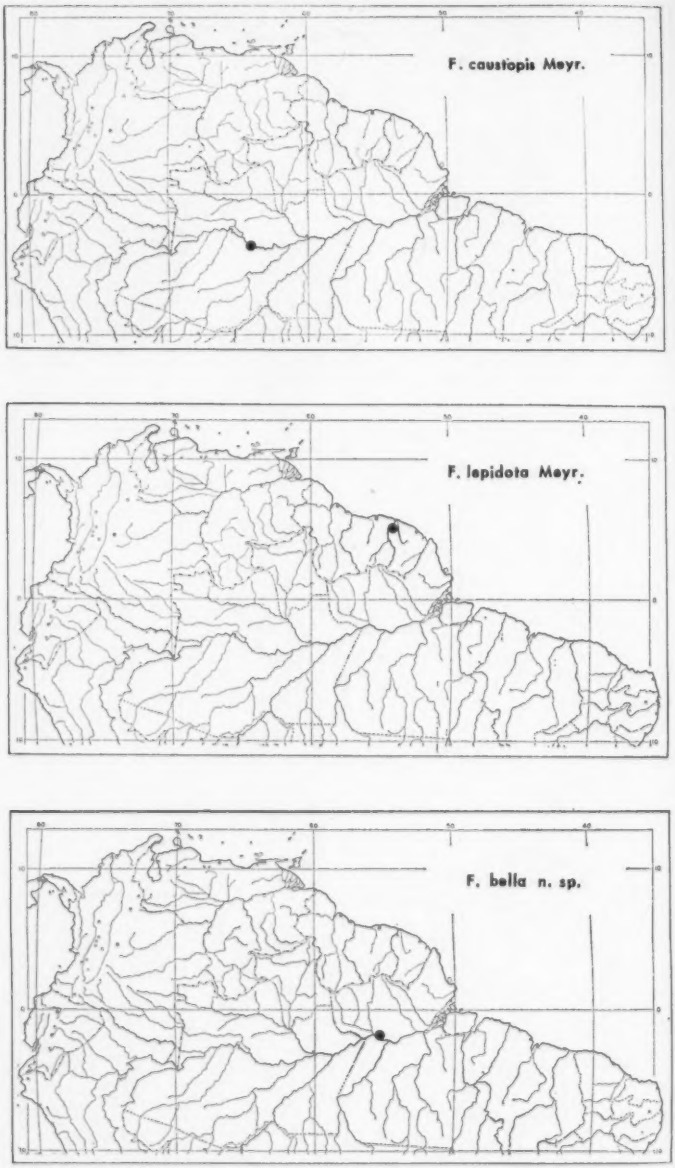

FIGURE 5.—Distribution of species of *Falculina*.

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REVISION OF THE GENUS *FURNARICOLA* (MALLOPHAGA) WITH DESCRIPTIONS OF NEW SPECIES

By M. A. CARRIKER, JR.

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A REVISION OF THE GENUS *FURNARICOLA* (MALLOPHAGA) WITH DESCRIPTIONS OF NEW SPECIES

By M. A. Carriker, Jr.[1]

The present paper has been prepared with much care for two reasons: The first and most urgent is to clarify the taxonomic position of the genus itself, which has been a controversial one since it was placed under the synonomy of *Rallicola* in the 1952 "Checklist of Mallophaga" by Hopkins and Clay. The second reason is to describe additional material which has been collected by the author since the genus was established in 1944 and also to record its occurrence on two other families of birds, from one of which no Mallophaga have previously been taken.

It will be noted that the bird hosts, with very few exceptions, have all been collected and prepared by the author himself, which has given him an unprecedented opportunity to verify the hosts in question and to check on any cases of suspected straggling.

All measurements are in millimeters and all drawings were prepared by the author with the greatest possible accuracy. Types, unless otherwise indicated, are in the author's collection.[2]

[1] Deceased July 27, 1965.

[2] Mr. Carriker bequeathed his entire collection of Mallophaga to the U.S. National Museum, where it is housed in the Department of Entomology.

The nomenclature of the bird hosts follows that of Peters' "Birds of the World."

Genus *Furnaricola* Carriker, 1944

Furnaricola Carriker, 1944, Bol. Ent. Venezolana, vol. 3, no. 2, p. 83.

Type species: *Furnaricola acutifrons* Carriker.

The genus was fully and accurately characterized in the original description and in that respect needs no further comment.

At the time the genus was established 8 species were placed in it, 5 from the Furnariidae, 2 from the Dendrocolaptidae, and 1 from the Formicaridae. Since then (in a paper published in 1963) the author has described 3 additional species from the Dendrocolaptidae. The hosts of the species from the Formicariidae, described in 1944, were under suspicion for some time, since I was under the impression that the genus might possibly be restricted to the Furnariidae and Dendrocolaptidae.

Later collecting has yielded numerous species of the genus, not only from the above-mentioned two families, but several more from the Formicariidae, and also, most unexpectedly, specimens were secured from two species of Pipridae (Manakins) and two from the genus *Scytalopus* (Rhynocryptidae), the latter being the first record of the taking of Mallophaga on this family of birds. Much care was taken in checking these host records, but there seems to be no reasonable doubt of their accuracy, especially those from *Scytalopus*.

A single female was taken on *Pipra pipra comata* (central Peru) and 1 female from *Pipra caeruleicapilla* (south Peru). They are typical of the genus but of a slightly distinct type, possessing certain special characters.

Two females were taken on *Scytalopus magellanicus affinis* (north Peru) and 2 females on *S. m. canus* (Colombia). The latter two also represent a slightly different type of insect. From the Formicariidae the following were secured: 2 pairs from *Myrmeciza immaculata*, 1 female from *M. laemosticta pallida*, and 1 female from *Pyriglena picea*. All are typical *Furnaricola* and prove conclusively that the genus is parasitic on at least five families of the Passeriformes and cannot possibly be congeneric with *Rallicola*.

In the present paper 4 species from the Dendrocolaptidae, 5 from the Furnariidae, 2 from the Formicariidae, 2 from the Pipridae, and 2 from the Rhynocryptidae are described as new to science. There is also another species now in press, from Venezuela, which will be noted on succeeding pages.

This is one of the controversial genera of Mallophaga, which, in the 1952 "Checklist of Mallophaga," was treated as a synonym of *Rallicola*.

Later Miss Clay published a paper in 1953 on "The *Rallicola*-complex" (Proc. Zool. Soc. London, vol. 123, pt. 3, pp. 563–587), in which it was maintained that *Furnaricola*, *Epipectus* Carriker, and *Corvicola* Carriker were synonyms of *Rallicola*. However, *Epipectus* is parasitic only on large woodpeckers (*Phloeoceastes* and *Dryocopus*, especially the former), and *Corvicola* is from a species of Corvidae from Guam Island.

Her contention is based on the fact that the heads of all three genera are of a similar type, that the male genitalia are similar in all three, and that a pair of ventral spines is present on each side of the distal segment of the abdomen in the females with a fringe of short spines around the posterior margin of the last sternite.

The species of *Rallicola*, found on the family Rallidae, are a somewhat heterogenous lot, many of them with strongly dimorphic antennae and other outstanding variations; they range in size from very minute to quite large. *Furnaricola* has proven to be a very large, very homogenous group in which there is never any sexual dimorphism in the antennae; there are also certain differences between it and *Rallicola* in the abdominal structure and chaetotaxy.

The numerous known species of *Furnaricola* are all of a similar type, with variations in the shape of the head, size of body, and always in the male genitalia, but the females are sometimes so closely related that their separation, without the male, is often difficult. The only certain manner that I have discovered for separation of the females is by the chaetotaxy of the last abdominal segment.

I think that it would be most unwise to place this genus under the synonomy of *Rallicola*, since it would utterly confuse any idea of the relationships between the Mallophaga and their hosts.

Key to Known Males of *Furnaricola* Based Largely on Genitalia

A. Paramera bifurcated on inner margin.
  a. Bifurcations long and slender, extending backward almost to base.
    b. Head large, with wider frons (.43×.39; frons .108) . . . **heterocephala**
    bb. Head smaller, frons narrower (.40×.35; frons .078) . . . . **laticephala**
  aa. Bifurcation much shorter.
    b. Distal half of outer margin of paramera straight . . . . . **titicacae**
    bb. Distal half of paramera slender and curving inward.
      c. Basal half of paramera wide, in contrast to slender, curving distal portion (paramera: .05) . . . . . **punensis**
      cc. Basal portion narrower; paramera long (1.05), tapering gradually from base to tip with a reverse curve . . . . . **myrmeciza**
AA. Paramera not bifurcated on inner margin.
  a. Distal portion of paramera straight on outer margin.
    b. Endomera with a rounded median, and pointed lateral, projections on basal margin.
      c. Distal portion of paramera very short, with the straight inner margin, terminating at tip of endomera . . . . . **parvigenitalis**

cc. Distal portion of parameres as long as wide basal portion and with inner margin sharply concave.

d. Basal plate shorter (.13); wide basal portion of paramera extending considerably beyond tip of endomera . . . **acutifrons acutifrons**

dd. Basal plate longer (.16); wide basal portion of paramera ending at tip of endomera . . . . . **acutifrons subsimilis**

bb. Endomera without prolongations on basal margins.

c. Basal margin of endomera concave.

d. Paramera long, tapering gradually from base to tip (.11).

e. Paramera straight on both sides; lateral carinae of basal plate swollen basally and with base concave . . . . . **lachrymosa**

ee. Paramera with distal half slightly concave on inner margin; carinae of basal plate not swollen basally . . **hirsuta picirostris**

dd. Paramera shorter; basal portion wide; distal portion concave on inner margin and tapering abruptly from tip of endomera to short, slender tip . . . . . **hirsuta hirsuta**

cc. Basal margin of endomera strongly convex; wide basal portion of paramera extends far beyond tip of endomera, with slender tip short and concave on inner margin . . . . . **cephalosa**

aa. Distal portion of paramera slender and more or less incurved.

b. Wide basal portion of paramera twice the length of short, slender curving tip . . . . . **certhia colombiana**

bb. Basal portion of paramera never twice the length of slender curving tip.

c. Basal plate much narrower at distal end than at base; wide basal portion of paramera concave on outer margin and extending beyond the tip of endomera . . . . . **certhia microgenitalia**

cc. Basal plate wider at distal end than at base.

d. Basal plate expanded at distal end; paramera rather slender basally, and with long, slender, slightly incurving tips longer than the wide basal portion . . . . . **triangularis**

dd. Basal plate not wider at distal end than at base.

e. Basal plate equal in length with paramera; sides straight. **longifrons**

ee. Basal plate considerably longer than paramera; wide basal portion of paramera about equal in length to slender, curving tips. **certhia certhia**

aaa. Paramera more or less straight, but with undulating outer and inner margins which are edged with blackish; endomera large, expanded laterally in median portion . . . . . **fuliginosa antioquénsis**

Key to Known Females of *Furnaricola*

(Length of head does not include hyaline tip of frons)

A. Head at least .05 mm. longer than wide at temples.

a. Head .075 mm. or more, longer than wide at temples.

b. Lateral spines on VIII long and slender; not more than 1 long and 3 short setae back of spines.

c. Pterothorax narrow (.30), with lateral margins but slightly divergent and straight, or almost so (never strongly convex); head with lateral margins straight from temples to frons; anterior plate extending beyond tips of preantennary carinae.

d. Head: .466×.36 . . . . . **acutifrons acutifrons**

dd. Head: .435×.35 . . . . . **parvigenitalis**

cc. Pterothorax wider (.315×.35), with lateral margins strongly convex.

d. Abdomen more slender (.48 wide); sternal portion of pleurites with a prominent projection on inner side, near anterior end. **acutifrons chocoana**

dd. Abdomen wider (.52), oval; pterothorax with lateral margins strongly divergent, convex; pleurites without inner projection (head: .47×.39) . . . . . **inexpectata**

bb. Lateral spines on VIII long, slender and of equal length; more than 3 short setae back of spines, usually 6.

c. Sides of head slightly convex; preantennary margin concave; preantennary carinae normal, submarginal, but not crenulated; 1 long, 1 medium, and 6 short setae on VIII (head: .47×.39) . . **longifrons**

cc. Sides of head straight from middle of temples to frons; 1 long, 1 medium, and 6 short setae on VIII.

d. Preantennary carinae wider, marginal, but with inner margin strongly crenulated (head: .456×.38) . . . . . **mirandae**

dd. Preantennary carinae narrow, black, submarginal, and corrugated; 1 long and 6 short setae back of spines on VIII. **acutifrons subsimilis**

aa. Head less than .075 mm. longer than wide, but not less than .05 mm. longer

b. Spines on VIII with anterior one shorter than posterior; pleurites and tergites strongly pigmented.

c. 1 medium long and 4 short setae back of spines on VIII; sides of head expanded laterally at clavi; lateral margins of temples flatly convex and with distinct, obtuse, posterolateral angles . . . . . **laticephala**

cc. 1 very long and 4 short setae back of spines; sides of head not appreciably expanded at clavi; temples uniformly circular; frons wide; anterior plate wider than long . . . . . **anabacerthia**

bb. Spines on VIII equal in length; may be long or short, thick or slender.

c. Spines on VIII very slender and long.

d. 1 longish and 6 short setae on VIII, all pointing forward from a narrow, irregular ridge; posterior half of head also more or less quadrilateral; frons narrow . . . . . **hirsuta picirostris**

dd. 2 long and 6 short setae on VIII; head expanded laterally at antennae; pleurites narrow, black; preantennary carinae with black, irregular inner margins . . . . . **hylactiphaga canae**

cc. Spines on VIII short and thick . . . . . **quadraticeps**

AA. Head less than 0.5 mm. longer than wide, but more than 0.18 mm.

a. Size large (body more than 1.80 long); spines on VIII short; 6 medium short setae (body length: 1.90; head, .56×.575) . . . . . **lachrymosa**

aa. Size medium (body 1.60–1.75 long).

b. Smaller, approximately 1.60 (head: .435×.39), spines on VIII very slender; 2 long, 1 medium, and 1 short setae; narrow, black, submarginal preantennary carinae . . . . . **hylactiphaga hylactiphaga**

bb. Larger, 1.70–1.75.

c. Frons narrow (head: .51×.48), and almost triangular in shape, but slightly expanded laterally at clavi; spines on VIII long and slender; 1 long and 5 short setae back of spines . . . . . **chunchotambo**

cc. Frons wide, with a very wide hyaline tip; temples broadly rounded; heads of blackish pleurites more or less pointed; spines on VIII short, equal; 1 long and 2 short setae . . . . . **titicacae**

aaa. Size very small, 1.40–1.55 in length.

b. Preantennary margin of head straight, or very faintly concave; spines on VIII long, anterior one shorter; 1 long, 1 medium, and 1 short setae back of spines. . . . . **heterocephala**

bb. Preantennary margin of head convex; spines on VIII short, posterior one the shorter; 1 long and 3 short setae, the latter set along posterior margin of segment . . . . . **myrmecina**

AAA. Head either wider than long, length and width equal, or else not more than .02 mm. longer than wide.

a. Head equal in length and breadth, or else wider than long.

b. Head with length and width at temples equal; anterior spine on VIII the longer; 4 long and 3 short setae set on a crenulated ridge . . . **triangularis**

bb. Head wider than long; temples expanded laterally (male) . . . **cephalosa**

aa. Head not more than .02 mm. longer than wide at temples.

b. Head triangular in shape, sides straight.

c. Five short setae set on a crenulated ridge on VIII all point forward; 4 short and scattered and 1 longish, point backward . . . **pipraphaga**

cc. Spines on VIII short and equal; 4 short scattered setae and 1 medium long on posterior margin of VIII (head: .50×.48) . . . . . **pyrigiena**

bb. Head triangular in shape but both preantennary margin and temples are convex, with head considerably larger (.575×.564); spines on VIII long and slender; 4 very short and 1 very long setae, back of spines, all of which point inward . . . . . **tergalis**

Furnaricola tergalis, new species

FIGURES 1, 1a, 2

Holotype female, and allotype male adults, from *Xiphocolaptes a. albicollis* (Vieillot), collected at Serra do Angrada, Edo. Rio de Janeiro, Brazil, by Dr. F. L. Werneck (Carriker type no. 786).

Diagnosis: One of the largest of the known species of the genus, with a very large, triangular-shaped head, with rounded temples and very wide frons, and with the hyaline tip unusually wide and circular.

Pleurites narrow and largely black; tergites reduced in width near pleurites and widely separated by hyaline bands. Sternites short (transversely) and also widely separated by hyaline bands. Segment VIII large, but lateral spines very short, and with 1 rather long and 3 very short setae posterior to them.

Male genitalia large; basal plate constricted in median portion, and with basal portion curiously complicated (see fig. 2); paramera rather short, thickened basally, and with short, slender tips, slightly curving; endomera large and of a type common to the genus. Represented by the female holotype, male allotype, and 3 male and 2 female paratypes.

Three females taken on *Xiphocolaptes promeropirhynchus sanctae-martae*, collected in the Sierra Nevada de Santa Marta, Colombia, cannot be separated from the Brazilian females. Perhaps the male genitalia, when known, will be found to differ.

Measurements follow the next species.

Furnaricola certhia certhia Carriker, 1963

FIGURES 2a, 3, 4

Furnaricola certhia certhia Carriker, 1963, Ann. Mag. Nat. Hist., ser. 13, vol. 5, p. 465, figs. 28–30.

Host: *Dendrocolaptes c. certhia* (Boddaert). (Carriker type no. 701, in British Museum (Natural History); male and female paratypes in Carriker collection.)

One of the larger species, with female much larger than male; the frons wide (.105 in both sexes); preantennary portion of head with margins strongly concave; basal plate wide (.11 at base); endomera short and wide (.06×.046); paramera rather long (.11), with apical half slender and curving inward, and with outer margins concave medially (see fig. 4).

Specimens from *D. certhia hyleorus* and *D. c. colombianus*, in the author's collection, differ sufficiently from *F. certhia* to merit subspecific rank and are described below.

Measurements of *F. tergalis*, new species, and *F. certhia* Carriker are as follows:

	tergalis ♂		tergalis ♀		certhia ♂		certhia ♀	
	length	*width*	*length*	*width*	*length*	*width*	*length*	*width*
body	1.50	–	1.79	–	1.59	–	2.00	–
head: frons	–	.13	–	.15	–	.105	–	.105
head: temples	.53	.50	.575	.564	.54	.525	.585	.565
prothorax	.16	.282	.162	.314	.16	.28	.185	.29
pterothorax	.198	.385	.217	.445	.22	.41	.14	.435
abdomen	.76	.54	1.00	.67	.845	.53	1.17	.62
basal plate	.23	.09			.25	.11		
paramera	.115	.09			.11	.09		
endomera	.07	.05			.06	.046		

Furnaricola certhia colombiana, new subspecies

FIGURE 5

Holotype, male adult, from *Dendrocolaptes certhia hyleurus* Wetmore, collected by the author at Volador, Dept. Bolívar, Magdalena Valley, Colombia, May 19, 1947 (Carriker type no. 787).

Diagnosis: This race of *certhia* is closely related to the nominate form from British Guiana. The measurements are very close, but the frons is wider (.14 against .105); the prothorax is slightly smaller; the basal plate narrower (.08 against .11); endomera longer and narrower, and the paramera are very differently shaped (see fig. 5), having the wide, basal portion very long and parallel-sided, with the tips very short, slender, and slightly incurved.

Represented by the male holotype and one male paratype.

***Furnaricola certhia microgenitalia*, new subspecies**

FIGURES 6, 7

Holotype male and allotype female adults, from *Dendrocolaptes certhia colombianus* Todd, collected by the author at Unguia, Dept. Chocó, Colombia, March 14, 1950 (Carriker type no. 788).

Diagnosis: Very distinct from the nominate race and from *F. certhia colombiana*, new subspecies. Smaller than *certhia*, especially the female (1.74 against 2.00), but males differ less (1.55 against 1.59); head smaller, with narrower frons and preantennary margins straight (concave in *certhia*) (male: head .52×.51, frons .108; female: head .54×.518, frons .11).

It will be noted that in this race there is much less sexual difference in size, especially of the head.

Unfortunately the condition of the types does not permit accurate measurement of the thorax and abdomen, or of figuring the chaetotaxy of segment VIII in the female.

The most striking difference is in the male genitalia, which differs greatly from both *certhia* and *colombiana* (see fig. 7). The basal plate is shorter and much attenuated distally, and the basal portion somewhat different; paramera are slightly longer than in *certhia* and are much longer than in *colombiana;* the general shape is somewhat as in *certhia* but the wide basal portion is much longer and parallel sided, tapering abruptly to the shorter, slender tips.

***Furnaricola lachrymosa*, new species**

FIGURES 4a, 8, 9

Holotype female and allotype male adults, from *Xiphorhynchus l. lachrymosus* (Lawrence), collected by the author at Quibdó, Dept. Chocó, Colombia, March 15, 1918 (Carriker type no. 789).

Diagnosis: One of the largest species of the genus presently known, with a very peculiarly shaped head, the posterior half being almost a quadrilateral, thence narrowing rapidly to the frons, and with lateral margins of preantennary portion strongly concave. Pleurites narrow and heavily chitinized, excepting the heads which are almost hyaline; tergites continuous across abdomen, closely fused with pleurites and with posterior margin hyaline; sternites prominent and in median portion of abdomen (see fig. 8).

Paramera straight and tapering. Legs small, with dark marginal carinae along outer side of femora and tibiae. Represented by female holotype, male allotype and male and female paratypes; also one male and one female from another individual of the type host. A single male from *X. lachrymosus alarum* Chapman, collected at Tarazá, Antioquia, is inseparable from the allotype. Measurements follow next species.

***Furnaricola hirsuta hirsuta*, new species**

FIGURES 10, 11, 16a, 17a

Holotype female and allotype male adults, from *Xiphorhynchus picus saturatior* (Hellmayr),[3] collected by the author at Puerto Venecia, Caquetá, Colombia, May 8, 1952 (Carriker type no. 790).

Diagnosis: A species very different from *lachrymosa*, although the hosts of both belong to the avian genus *Xiphorhynchus* (see footnote). It is strongly pigmented and with certain cephalic carinae and anterior portion of paratergals black; abdominal sclerites rather distinct, as well as the sternal fringe of short spines and the two long spines on each side of sternite VIII. First and third femora, and third tibiae unusually large and with strong claws. Lateral margins of preantennary portion of head almost straight; frons narrow and anterior plate long and narrow.

Basal plate of male genitalia with wide marginal carinae; paramera with basal two-thirds wide, and thence tapering sharply to the short, straight, and narrow apical portion. Represented by female holotype, male allotype, and one male and five female paratypes. One male and one female from the type host collected at Cúcuta are slightly intermediate between *hirsuta* and the next subspecies but closer to the former.

A male and two females from Rio Viejo (eastern Dept. Bolivar, Magdalena Valley), within the range of *X. p. dugandi*, although differing slightly from specimens of *picirostris* (the following subspecies), must be placed under that race, whose host is *X. p. picirostris*.

Specimens from Pto. Venecio and Coveñas (*hirsuta*) are the smallest of the different populations, are the most deeply pigmented, and also differ in the male genitalia and chaetotaxy of segment VIII of the female.

Figures are given of the male genitalia of *hirsuta* (Pto. Venecia) and of *picirostris* (from El Conejo), also the chaetotaxy of segment VIII of the females of *picirostris* from Rio Vieja (16a) and El Conejo (19a) which, it will be noted, are very similar, while that of *hirsuta* (Pto. Venecia) is very different. Certainly much more material from the different subspecies of *Xiphorhynchus picus* is required in order to satisfactorily classify the forms of *Furnaricola* parasitic on them.

The chaetotaxy of segment VIII in the females and the male genitalia have been largely used in the classification of the species and subspecies of this genus, the characters which appear to be the

[3] I have examined 5 males and 10 females from three supposedly different subspecies of *Xiphorhynchus picus*. All are conspecific but may be roughly divided into two subspecies. In addition to the specimens cited above from *X. p. saturatior*, there is a single female from Coveñas (coast of Dept. Bolivar) in the range of *X. p. dugandi* which cannot be separated from them, being small and deeply colored, and must be called *F. h. hirsuta*.

most dependable, but I have not been able to examine a sufficient number of specimens from the same host species to determine to what extent the chaetotaxy may vary.

Nevertheless, the setae present on the head, prothorax, and last abdominal segment of species in other genera of Mallophaga are being used extensively now as identifying characters for species and species groups, so that it seems logical that they may be successfully used in *Furnaricola*.

Until recently *Xiphorhynchus picus* has been placed always under the genus *Dendroplex*, where I believe it should have remained. Both in morphology and habitat, *picus* differs strongly from *Xiphorhynchus* auct. whose species are strictly forest dwellers, while in *Dendroplex picus* we have a species habitually found in semiarid open scrub, composed largely of xerophytic vegetation, and they are often seen out in the open on fenceposts. As further proof we have the very great difference in the type of Mallophagan parasites which infest them.

Measurements of the types of *F. lachrymosa* and *F. h. hirsuta* are as follows:

	lachrymosa ♂		lachrymosa ♀		hirsuta ♂		hirsuta ♀	
	length	*width*	*length*	*width*	*length*	*width*	*length*	*width*
body	1.63	–	1.91	–	1.33	–	1.40	–
head frons	–	.108	–	.12	–	.087	–	–
head temples	.51	.48	.56	.525	.43	.40	.467	.423
prothorax	.155	.28	.174	.303	.115	.24	.132	.26
pterothorax	.228	.38	.22	.412	.14	.347	.195	.365
abdomen	.86	.53	1.08	.608	.65	.435	.75	.48
basal plate	.21	.087			.20	.087		
paramera	.13	.087			.08	.07		
endomera	.07	.045			.05	.041		

***Furnaricola hirsuta picirostris*, new subspecies**

FIGURES 12, 19a

Holotype female and allotype male adults, from *Xiphorhynchus picus picirostris* (Lafresnaye), collected by the author at El Conejo, Sierra Perijá, Colombia, March 18, 1945 (Carriker type no. 791).

Diagnosis: Resembles the nominate race in general appearance, but in measurements, some are greater, some are less, and some are the same. It is larger than *hirsuta*, especially the female, with longer and wider head, but with frons the same width; prothorax same in male, larger in female; pterothorax larger in both sexes; abdomen longer and wider in male and much longer in female.

Male genitalia differ in shape and length of paramera, those of *picirostris* being much longer and much narrower basally. Measurements follow next species.

***Furnaricola triangularis*, new species**

FIGURES 13, 14, 22a

Holotype female and allotype male adults, from *Lepidocolaptes souleyetii lineaticeps* (Lafresnaye), collected by the author at El Conejo, Sierra Perijá, Colombia, March 18, 1945 (Carriker type no. 792).

Diagnosis: Head practically an equilateral triangle, with narrow frons, rounded temples, and with anterior plate and its supporting carinae extending for half the length of plate beyond the tips of the preantennary carinae.

Pleurites heavily pigmented and with their heads forming a reverse hook; spiracles large and hyaline. Basal plate long and much wider at distal end; both paramera and endomera differ in details. Represented by holotype female, allotype male, and three male and one female paratypes. Three females from *Lepidocolaptes affinis sneiderni*, collected at Urráo, Antióquia, cannot be separated from *triangularis*. When the male from *L. a. sneiderni* is known it may show differences in the genitalia which would separate it from *triangularis*, but for the present it seems best to make no attempt to separate it subspecifically.

Measurements of the types of *F. hirsuta picirostris* and *F. triangularis* are as follows:

	picirostris ♂		picirostris ♀		triangularis ♂		triangularis ♀	
	length	*width*	*length*	*width*	*length*	*width*	*length*	*width*
body	1.45	–	1.78	–	1.40	–	1.68	–
head: frons	–	.12	–	.13	–	.098	–	.098
head: temples	.49	.445	.50	.48	.445	.415	.456	.45
prothorax	.14	.264	.14	.264	.14	.24	.13	.26
pterothorax	.185	.365	.195	.382	.17	.352	.21	.39
abdomen	.78	.50	1.08	.53	.74	.51	1.13	.564
basal plate	.18	.081			.21	.14		
paramera	.09	.081			.097	.081		
endomera	.063	.041			.067	.037		

***Furnaricola fuliginosa fuliginosa* Carriker, 1963**

Furnaricola fuliginosa Carriker, 1963, Ann. Mag. Nat. Hist., ser. 13, vol. 5, p. 467, figs. 34–35.

Host: *Dendrocincla f. fuliginosa* (Vieillot). Types in British Museum (Natural History).

In this species the head is similar to that of *certhia*, but very much smaller; the anterior plate extends farther beyond the preantennary carinae and is narrower; thoracic segments same shape as in *guttata* Carriker, but male genitalia smaller and with both basal plate and endomera quite distinct in structure.

It may be noted that the male genitalia in the present species, in *certhia*, and in *guttata* are in proportion to the size of the hosts, that of *certhia*, being the largest and that of *fuliginosa* the smallest.

In the author's collection are 2 males of this species from *D. f. lafresnayei*, collected in Antióquia, Colombia, which differ so strongly from *fuliginosa* that they must be given subspecific rank, and are described below.

***Furnaricola fuliginosa antioquénsis*, new subspecies**

FIGURES 15, 16

Holotype male adult, from *Dendrocincla fuliginosa lafresnayei* Ridgway, collected by the author at Tarazá, Antióquia, Colombia (Rio Cauca), April 26, 1948 (Carriker type no. 793).

Diagnosis: Very much larger in all measurements than the nominate form. Head also similar in shape to that of *certhia*, but has narrower frons and much wider clavi; preantennary carinae narrower basally and antennae thicker. There are also differences in the structure of the genitalia but the much larger size alone is sufficient for its separation from *fuliginosa*. Represented by the male holotype and one male paratype.

Measurements follow the next species.

***Furnaricola quadraticeps*, new species**

FIGURES 17, 23a

Holotype female adult, from *Cichocolaptes leucophrys* (Jardine and Selby),[4] collected by Dr. F. L. Werneck at Serra do Angradas, Edo. Rio de Janeiro, Brazil (Carriker type no. 794).

Diagnosis: Head of a very unusual shape, the portion posterior to the antennary fossae being quite quadrilateral in shape, with slightly rounded templar angles and undulating occipital margin; the preantennary portion of head consists of a perfect truncated cone, with wide, heavily pigmented preantennary carinae.

The thorax and abdomen show no distinctive characters, except the very short spines, with thickened bases, at sides of segment VIII and with only 3 short setae back of them; segment VIII is small in comparison to size of abdomen. Undoubtedly the male, when taken, will show decisive differences in the genitalia. Represented by the female holotype and four female paratypes.

Measurements of male holotypes of *F. f. fuliginosa*, *F. f. antioquénsis*, and female holotype of *F. quadraticeps* are as follows:

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[4] For change of name from *Anabates ferruginolentus* Wied to *Cichocolaptes leucophrys* (Jardine and Selby), see Peters, "Birds of the World," 1951, vol. 7, p. 140.

	fuliginosa ♂		antioquensis ♂		quadraticeps ♀	
	length	*width*	*length*	*width*	*length*	*width*
body	1.41	–	1.69	–	1.71	–
head: frons	–	.087	–	.152	–	.12
head: temples	.445	.423	.58	.564	.51	.456
prothorax	.14	.25	.205	.337	.14	.28
pterothorax	.185	.337	.26	.458	.235	.41
abdomen	.74	.458	.87	.61	.966	.58
basal plate	.173	.064	.306	.105		
paramera	.092	.067	.115	.028		
endomera	.05	.043	.071	.051		

***Furnaricola anabacerthia*, new species**

FIGURES 18, 24a

Holotype female adult, from *Anabacerthia striaticollis* Lafresnaye, collected by the author at Virolin, Dept. Santander, Colombia, Sept. 19, 1943 (Carriker type no. 795).

Diagnosis: Also one of the larger species (female, 1.70×.525), but with the head of a different shape. Temples rounded; occipital margin slightly undulating; preantennary margin almost straight; frons wide and anterior plate small, protruding, and wider than long. Pleurites heavily pigmented, ventral portion wider than dorsal; heads large and rounded; anterior margin of tergites incised laterally and with hyaline bands along both sides; sternites as in *lachrymosa*, but wider laterally. Represented by female holotype and one female paratype.

Measurements follow next species.

***Furnaricola longifrons*, new species**

FIGURES 19, 20, 25a

Holotype female and allotype male adults, from *Margarornis squamigera perlatus* (Lesson), collected by the author at La Palmita, Santander Norte, Colombia, Aug. 14, 1916. (Carriker type no. 796.)

Head unusually long (female, .477×.39); temples rounded and with lateral margins converging from middle of temples to the wide frons; preantennary margin slightly concave; anterior plate short, wider than long and with anterior edge convex and posterior concave; preantennary carinae submarginal; abdominal sclerites normal.

Basal plate of male genitalia very short, with length but little more than that of the paramera (see fig. 20); paramera with thickened bases and long, slender, slightly in-curved apical portion; endomera almost parallel sided, with slender tip. Represented by female holotype, male allotype, and two female paratypes.

Measurements of the types of *F. anabacerthia* and *F. longifrons* are as follows:

	anabacerthia ♀		longifrons ♂		longifrons ♀	
	length	*width*	*length*	*width*	*length*	*width*
body	1.70	–	1.44	–	1.59	–
head frons	–	.14	–	.13	–	.13
head temples	.48	.42	.456	.38	.477	.39
prothorax	.15	.26	.14	.215	.14	.25
pterothorax	.195	.38	.185	.33	.195	.347
abdomen	1.00	.525	.80	.435	.92	.50
basal plate			.123	.077		
paramera			.11	.077		
endomera			.063	.033		

Furnaricola acutifrons acutifrons Carriker, 1944

FIGURES 6a, 32

Furnaricola acutifrons Carriker, 1944, Bol. Ent. Venezolana, vol. 3, no. 2, p. 86, pl. 4 (figs. 1, 2), pl. 5 (fig. 1).

Host: *Synallaxis albescens perpallida* Todd.

Head long and slenderly conical, similar to *F. acutifrons chocoana*, new subspecies; anterior plate protruding far beyond tips of preantennary carinae; pleurites with long, pointed heads (not rounded or hooked), black in median portion like *F. punensis*, new species; male genitalia similar to those of *F. a. chocoana;* (female; body, 1.71×.48; head, .46×.26); three short setae back of spines in VIII.

Furnaricola acutifrons subsimilis Carriker, 1944

FIGURES 18a, 33

Furnaricola acutifrons subsimilis Carriker, 1944, Bol. Ent. Venezolana, vol. 3, no. 2, p. 87.

Host: *Leptoxyura cinnamomea=Certhiaxis cinnamomea fuscifrons* (Madarasz).

Very closely related to *acutifrons*, but head slightly longer and wider; pterothorax shorter and wider; endomera wider in anterior portion and narrower posteriorly; basal plate not constricted near distal end, but parallel sided; spines on VIII long and slender; one long, four short setae; (female; body, 1.74×.48; head, .48×.38).

Furnaricola acutifrons chocoana, new subspecies

FIGURES 21, 22, 26a

Holotype female and allotype male adults, from *Synallaxis albescens hypoleuca* Ridgway, collected by the author at Ungufa, Dept. Choco, Colombia, March 11, 1950 (Carriker type no. 797).

Diagnosis: A very strikingly shaped head, much longer than wide, and with short, squarish temples (head, female, .46×.37) and long, tapering preantennary portion; bucal canal narrow and anterior plate small. Dorsal portion of pleurites narrow, blackish medially, while sternal portion is uniformly pigmented, wide, and with a small, rounded protuberance on inner margin, slightly posterior to the head.

Only sternite visible is the genital plate, covering median portion of segments VI and VII; structure and chaetotaxy of VIII distinct (see fig. 26a).

Male genitalia small; basal plate short; paramera with thickened bases and long, incurving tips; endomera of usual shape (see fig. 22).

Represented by the female holotype, the male allotype, and one male paratype.

Measurements follow next species.

***Furnaricola punensis*, new species**

FIGURES 11a, 23, 24

Holotype (and only specimen) male adult, from *Synallaxis c. cabanisi* Berlepsch and Leverkühn, collected by the author at Bella Pampa, S. Peru, June 6, 1931 (Carriker type no. 798).

Diagnosis: A small species with rather narrow, conical head, with wide frons, rounded temples and strongly undulating occipital margin. The preantennary carinae are short, blackish, and submarginal; antennae unusually thick and gular sclerite of unusual shape.

First abdominal segment very large, parallel sided, and as wide as pterothorax. Male genitalia strikingly different, almost unique. Paramera with basal portion wide and parallel sided, with slender, curving tips arising from outer portion and with a rather long, slender bifurcation on inner margin (see fig 24); endomera also long, with swollen sides and wide, truncate tip.

The only other species described in the present paper with bifurcated paramera is *myrmeciza*, from an antbird (Formicariidae), but in my first paper on the genus (Bol. Ent. Venezolana, vol. 3, no 2, pp. 83–96) there are three species with bifurcated paramera, two quite similar, with the bifurcation starting near base of paramera (*heterocephala* and *laticephala*), one from a Furnariidae, the other from a Formicariidae. The third species has a short bifurcation similar to the present species and is from a Furnariidae also.

Until much more material is available for study it is impossible to assign this type of genitalia to any particular type of host.

Measurements of *F. acutifrons chocoana* and *F. punensis* are as follows:

	chocoana ♂		chocoana ♀		punensis ♂	
	length	*width*	*length*	*width*	*length*	*width*
body	1.45	—	1.78	—	1.39	—
head: frons	—	.076	—	.087	—	.108
head: temples	.40	.326	.46	.37	.391	.35
prothorax	.13	.198	.14	.225	.13	.206
pterothorax	.185	.282	.217	.314	.185	.282
abdomen	.76	.37	1.09	.477	.825	.445
basal plate	.15	.065			.16	.044
paramera	.077	.066			.05	.03
endomera	.04	.09			.04	.026

***Furnaricola myrmeciza*, new species**

FIGURES 12a, 25, 26

Holotype female and allotype male adults, from *Myrmeciza i. immaculata* (Lafresnaye), collected by the author at Hcda. Santana, Santander, Colombia, Oct. 10, 1949 (Carriker type no. 799).

Diagnosis: May be recognized by the shape of the head, the entire lateral margins from base of temples to frons uniformly convex (see fig. 25), and with the hyaline band around frons wide. Heads of pleurites slender, pointed, and curved inward. The holotype has three long spines on right side of segment VIII and the usual two on left side. Have seen one other case of three spines on right side of VIII.

Male genitalia very characteristic, there being presently no other known species quite like it. The basal plate is small, expanded at anterior end; paramera nearly as long as basal plate, slender, tapering, with a reverse curve, and with a slender bifurcation at sides of endomera; endomera typical.

Represented by the female holotype, male allotype and one male and one female paratypes, and by a single female from *Myrmeciza laemosticta pallida*, collected at Hcda. Belen, Antióquia, which cannot be separated from the female holotype. Measurements follow next species.

***Furnaricola pyriglena*, new species**

FIGURES 13a, 27

Holotype female adult, from *Pyriglena leuconota picea* Cabanis, collected by the author at Eneñas, Chanchamayo, Peru, March 4, 1930 (Carriker type no. 800).

Diagnosis: A rather large species with a conical-shaped head, narrow frons and rounded temples. There are no outstanding characters for this species, excepting shape of head, anterior and gular plates and shape of segment VIII of abdomen. Legs small, especially the coxae and second leg; median portion of pleurites black.

Measurements of the types of *F. myrmeciza* and *F. pyriglena* are as follows:

	myrmeciza ♂		myrmeciza ♀		pyriglena ♀	
	length	*width*	*length*	*width*	*length*	*width*
body	1.41	–	1.54	–	1.78	–
head frons	–	.11	–	.10	–	1.08
head temples	.434	.358	.43	.385	.50	.48
prothorax	.12	.235	.13	.24	.155	.27
pterothorax	.19	.303	.205	.337	.175	.37
abdomen	.673	.458	.91	.49	1.06	.54
basal plate	.14	.04				
paramera	.105	.073				
endomera	.06	.036				

***Furnaricola pipraphaga*, new species**

FIGURES 15a, 28

Holotype female adult, from *Pipra pipra comata* Berlepsch and Stolzman, collected by the author at Eneñas, Chanchamayo, Peru, March 12, 1930 (Carriker type no. 801).

Diagnosis: Head decidedly triangular, somewhat similar to that of *F. triangularis*, but the mandibles are quite different, as well as the preantennary carinae, clavi and gular plate (see fig. 28). Head also resembles that of *pyriglena* in shape, but the abdominal sclerites are very different, the tergites in *pyriglena* almost filling the segments and with prominent sternites in III–VII, while in the present species the pleurites are without heads and tergites widely separated by hyaline bands, and the sternites, if present, are entirely invisible, excepting the genital sternite covering portions of VII and VIII.

One long and five short setae behind the short, slender lateral spines. Male unknown. Represented by the holotype female only.

Measurements follow next species.

***Furnaricola inexpectata*, new species**

FIGURES 14a, 29

Holotype female adult, from *Pipra caeruleicapilla* Tschudi, collected by the author at La Pampa, southeast Peru, July 8, 1931 (Carriker type no. 802).

Diagnosis: Head very differently shaped from that of *F. pipraphaga* described above, being somewhat similar to that of *F. acuticeps chocoana*, but with more rounded temples and much wider frons and with wide, heavily pigmented preantennary carinae having corrugated inner margins. The gular plate very similar to that of *pipraphaga*, but pterothorax longer and wider and with third pair of legs much smaller. Also lacks the sternites as in *pipraphaga;* long spines on VIII similar, but only three very short setae back of them.

Measurements of the types of *F. pipraphaga* and *F. inexpectata* are as follows:

		pipraphaga ♀		inexpectata ♀	
		length	*width*	*length*	*width*
body		1.68	–	1.56	–
head	frons	–	.108	–	.108
	temples	.467	.458	.467	.391
prothorax		.14	.25	.13	.24
pterothorax		.18	.35	.174	.347
abdomen		1.00	.61	.89	.52

Note: There is a faint possibility of straggling in the case of this and the preceding species, although no real proof. The genus *Furnaricola* is, on the whole, quite sedentary in its habits, clinging tightly to the feathers of the dead bird, and not moving about as do many other genera. The only thing that is suspicious

is the fact that the two females are so very different, while both are from hosts of the same genus. Further checks are being made to find out what species of birds were actually collected on the two days corresponding to the dates of the taking of the two specimens under discussion.

***Furnaricola hylactiphaga hylactiphaga*, new subspecies**

FIGURES 20a, 30

Holotype female adult, from *Scytalopus magellanicus affinis* Zimmer, collected by the author at Yanac, Huascarán, Peru, March 22, 1932 (Carriker type no. 803).

Diagnosis: Head slenderly conical, with the short, broken, preantennary carinae black; gular plate small and without appendages; thoracic segments normal; abdomen elongated oval, with deeply pigmented, narrow pleurites; tergites heavily pigmented in outer portion and pale in median portion.

Tergites separated medially, with rounded ends. The only known host on which have been taken *Furnaricola* with this type of tergites is *Scytalopus*.

Six rather longish setae behind the short, lateral spines on VIII. Male unknown. Represented by the female holotype and one female paratype.

It will be most interesting to see what type of genitalia is present in the species from *Scytalopus*, and also in those from the Pipridae.

Measurements follow next species.

***Furnaricola hylactiphaga canae*, new subspecies**

FIGURES 21a, 31

Holotype female adult, from *Scytalopus magellanicus canus* Chapman, collected by the author at Heda. Potreros, near Frontino, Antióquia, Colombia, June 7, 1950 (Carriker type no. 804).

Diagnosis: As in the nominate race, the tergites are divided medially; the pleurites are narrow dorsally and partly black, with wider, paler sternal portion; head with preantennary margin slightly concave and with temples more expanded. Anterior plate rather long, and divided as in the nominate race (see fig. 31). Sternal spines on VIII short, with 1 long and 5 very short setae behind them. Male unknown. Represented by the holotype female and one female paratype.

Measurements of *F. h. hylactiphaga* and *F. hylactiphaga canae* are as follows:

		hylactiphaga ♀		canae ♀	
		length	*width*	*length*	*width*
body		1.60	–	1.41	–
head	frons	–	.09	–	.105
	temples	.435	.39	.415	.358
prothorax		.108	.228	.12	.206
pterothorax		.19	.43	.16	.293
abdomen		.955	.51	.80	.415

Furnaricola parvigenitalis Carriker, 1944

FIGURE 8a

Furnaricola parvigenitalis Carriker, 1944, Bol. Ent. Venezolana, vol. 3, no. 2, p. 88, pls. 4 (figs 3, 4), 5 (fig. 2).

Host: *Synallaxis erythrogaster* Sclater.

Head similar to that of *punensis*, new species, but narrower at temples and with the preantennary carinae continuous to tip of frons; frons narrow, with anterior plate protruding almost entirely beyond tips of preantennary carinae; bucal canal much narrower than in *punensis*; male genitalia very different (see key); (female: body, 1.59×.45; head, .435×.35).

Furnaricola laticephala Carriker, 1944

FIGURE 27a

Furnaricola laticephala Carriker, 1944, Bol. Ent. Venezolana, vol. 3, no. 2, p. 89, pls. 4 (figs. 5, 6), 5 (fig. 3).

Host: *Cranioleuca subcristata* (Sclater).

Head unlike any species here figured. Sides of temples nearly straight, with blunt posterolateral angles (not rounded); head nearly as wide at clavi as at temples, converging rapidly from clavi to frons, with sides concave. Pleurites wider and paler ventrally than dorsally; tergites pale but sternites heavily pigmented. Male genitalia with paramera bifurcated; paramera straight, with short, slender tips; (female: body, 1.73×.586; head, .445×.41).

Furnaricola titicacae Carriker, 1944

FIGURE 10a

Furnaricola titicacae Carriker, 1944, Bol. Ent. Venezolana, vol. 3, no. 2, p. 91, pls. 4 (figs. 7, 8), 5 (fig. 4).

Host: *Phleocryptes melanops schoenbaenus* Cabanis and Heine.

One of the larger species and somewhat aberrant in structure of preantennary portion of head; frons very wide (.135) and completely encircled by a wide hyaline band. It is also one of the species in which the male has bifurcated paramera (see keys); (female: body, 1.73×.59; head, .445×.41).

Furnaricola chunchotambo Carriker, 1944

FIGURE 3a

Furnaricola chunchotambo Carriker, 1944, Bol. Ent. Venezolana, vol. 3, no. 2, p. 92, pl. 6 (fig. 1).

Host: *Xiphorhynchus chunchotambo=X. ocellatus chunchotambo* (Tschudi).

Head triangular in shape, wide at rounded temples, with lateral margins expanded slightly at clavi; frons narrow; anterior plate half

the length of bucal canal and does not extend beyond tips of preantennary carinae; bucal canal expanded laterally in median portion; gular plate with pointed, lateral sclerites at base; tergites very pale and sternites invisible. Male unknown; (female: body, 1.74×.52; head, .54×.477).

***Furnaricola cephalosa* Carriker, 1944**

Furnaricola cephalosa Carriker, 1944, Bol. Ent. Venezolana, vol. 3, no. 2, p. 94, pl. 6 (figs. 2, 3).

Host: *Glyphorhynchus spirurus pectoralis*=*G. s. sublestes* Peters.

Female unknown.

Head very wide at temples, wider than abdomen, semitriangular in shape. Sides of head much expanded laterally at clavi; bucal canal very short; anterior plate wider than long, short, and not protruding. Pleurites wider ventraly, dark brown; tergites very pale; sternites prominent and dark brown; (male: body, 1.18×41; head, .39×.43). For genitalia, see key.

***Furnaricola heterocephala* Carriker, 1944**

Furnaricola heterocephala Carriker, 1944, Bol. Ent. Venezolana, vol. 3, no. 2, p. 95, pl. 4 (figs. 4–6).

Host: *Gymnocichla c. chiroleuca*=*G. nudiceps chiroleuca* Sclater and Salvin.

Female: body, 1.45×.50; head, .45×.40.

Shape of head much as in *anabacerthia*, new species, but prothorax narrower; segment I of abdomen narrower; pleurites parallel sided (not swollen at heads as in *anbacerthia*); two long and two short setae back of spines on VIII.

Basal plate very short, with rounded distal end wider than at base; paramera bifurcated as in *parvigenitalis*, but paramera thicker basally and with tips more slender; endomera more or less as in *myrmeciza*, new species.

Tergites and sternites about equal in color, light brown; sternites narrower than tergites, are separated by wide hyaline bands, and are darker along posterior margin.

***Furnaricola guttata* Carriker, 1963**

Furnaricola guttata Carriker, 1963, Ann. Mag. Nat. Hist., ser. 13, vol. 5, p. 466, figs. 31–33.

Host: *Xiphorhynchus guttatus polystictus* (Salvin and Godman) (Carriker type no. 702); types in British Museum (Natural History).

Superficially resembles *certhia* Carriker, but head narrower at both frons and temples; prothorax parallel sided as in *chunchotambo* Carriker; the peculiar clear sternal sclerites of the thorax are unusual. Male genitalia same type as that of *certhia* but smaller, especially

the basal plate, and paramera differ in shape; (female: body, 174×.565; head, .51×.468).

***Furnaricola mirandae* Carriker, 1963**

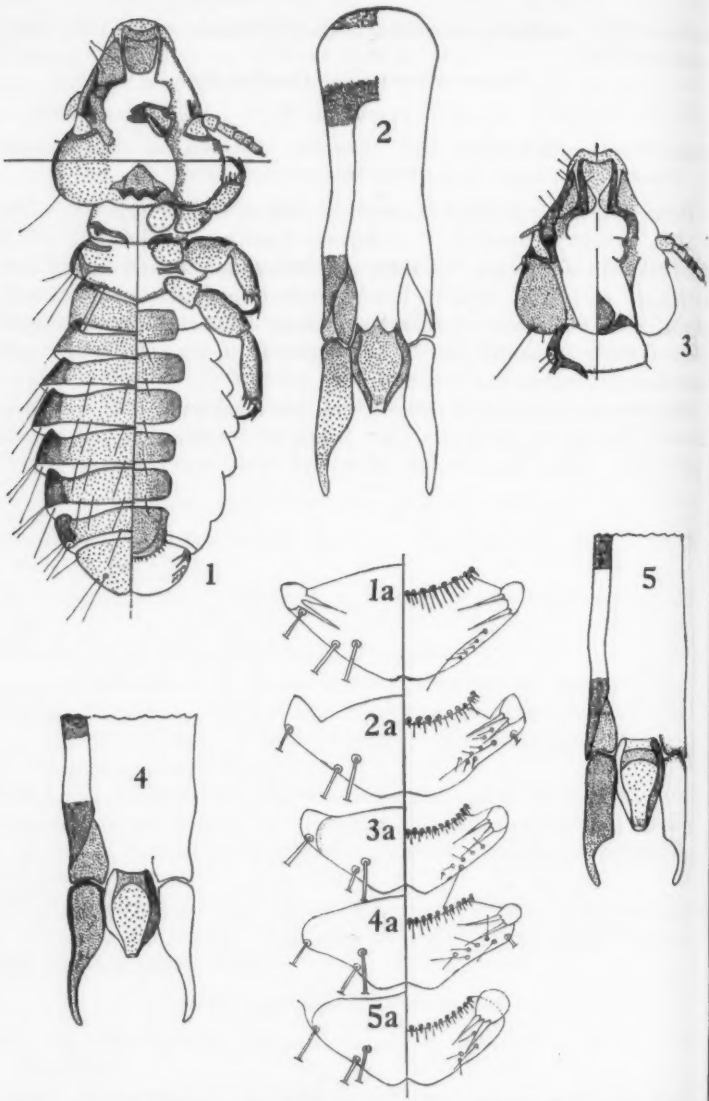
FIGURE 5a

Furnaricola mirandae Carriker, 1963, Mem. Soc. Cien. Nat. La Salle, Caracas, Venezuela, vol. 23, p. 30, pl. 10 (fig. 2).

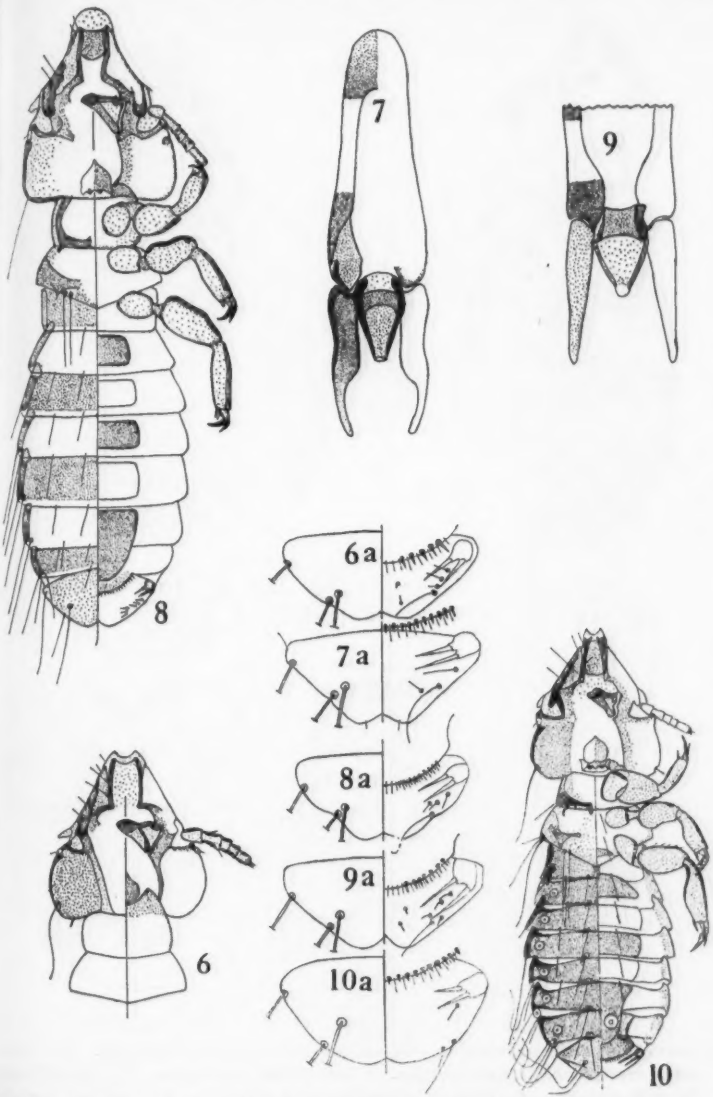
Host: *Synallaxis unirufa castanea* Sclater (Carriker type no. 680).

Most closely related to *F. acutifrons* Carriker, differing in wider frons and anterior plate, the latter not extending beyond tips of preantennary carinae; a hyaline band, concave medially, around frons; pterothorax with lateral margins convex and strongly divergent (very slightly in *acutifrons*); ventral portion of pleurites wider and more deeply colored than dorsal.

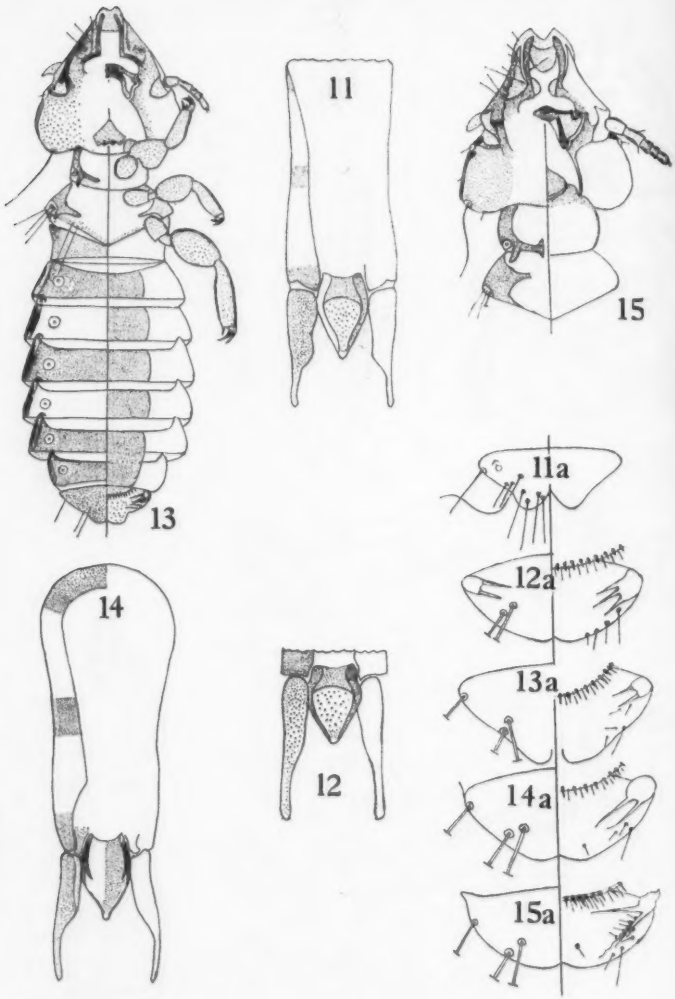
Body much shorter than in *acutifrons*, but head nearly the same size. Known from a single female, the holotype (body, 1.50×.46; head, .456×.38). (See figure 5a for spines and setae on segment VIII.)



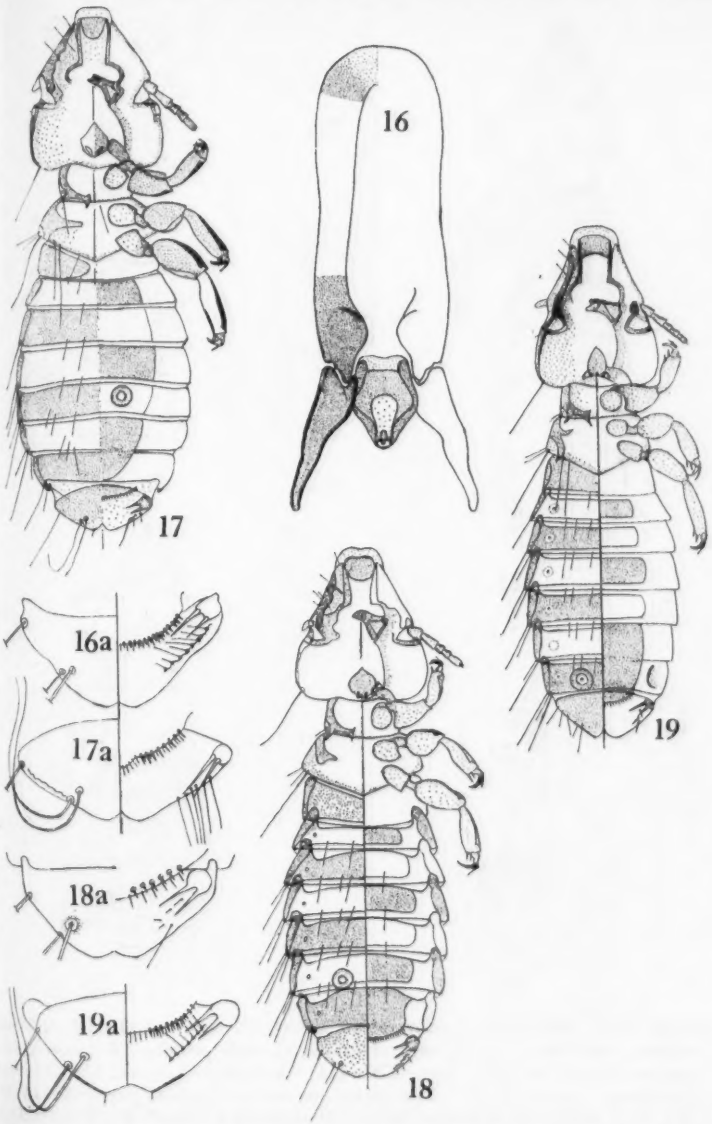
FIGURES 1–5.—*Furnaricola tergalis*, new species: 1, body of male; 2, male genitalia. *F. certhia certhia* Carriker: 3, head and prothorax of male; 4, male genitalia. *F. certhia colombiana*, new subspecies: 5, male genitalia. FIGURES 1a–5a.—Chaetotaxy of segment VIII of females (bird hosts in parens): 1a, *F. tergalis*, new species (*Xiphocolaptes a. albicollis*); 2a, *F. certhia* Carriker (*Dendrocolaptes c. certhia*); 3a, *F. chunchotambo* Carriker (*Xiphorhynchus ocellatus chunchotambo*); 4a, *F. lachrymosa*, new species (*X. l. lachrymosus*); 5a, *F. mirandae* Carriker (*Synallaxis unirufa castanea*).



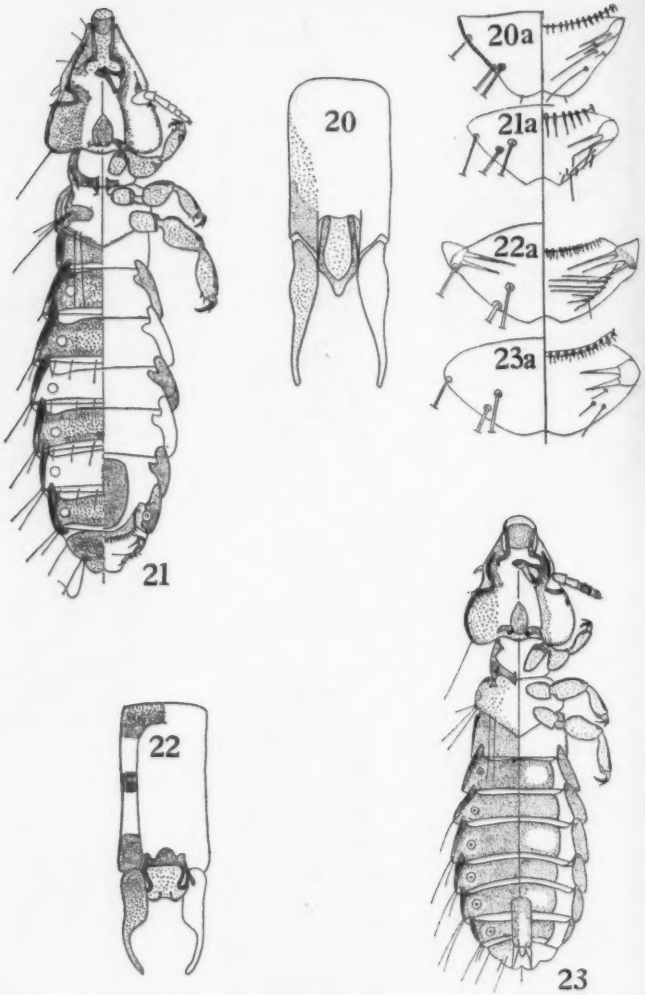
FIGURES 6–10.—*Furnaricola certhia microgenitalis*, new subspecies: 6, head and thorax of male; 7, male genitalia. *F. lachrymosa*, new species: 8, body of female; 9, male genitalia. *F. hirsuta hirsuta*, new species: 10, body of female. FIGURES 6a–10a.—Chaetotaxy of segment VIII of females (bird hosts in parens): 6a, *F. a. acutifrons* Carriker (*Synallaxis albescens perpallida*); 7a, *F. heterocephala* Carriker (*Gymnocichla nudiceps chiroleuca*); 8a, *F. parvigenitalis* Carriker (*Synallaxis erythrogastra*); 9a, *F. acutifrons subsimilis* Carriker (*Synallaxis cinnamomeus fuscifrons*); 10a, *F. titicacae* Carriker (*Phloecryptes melanops schoenbaenus*).



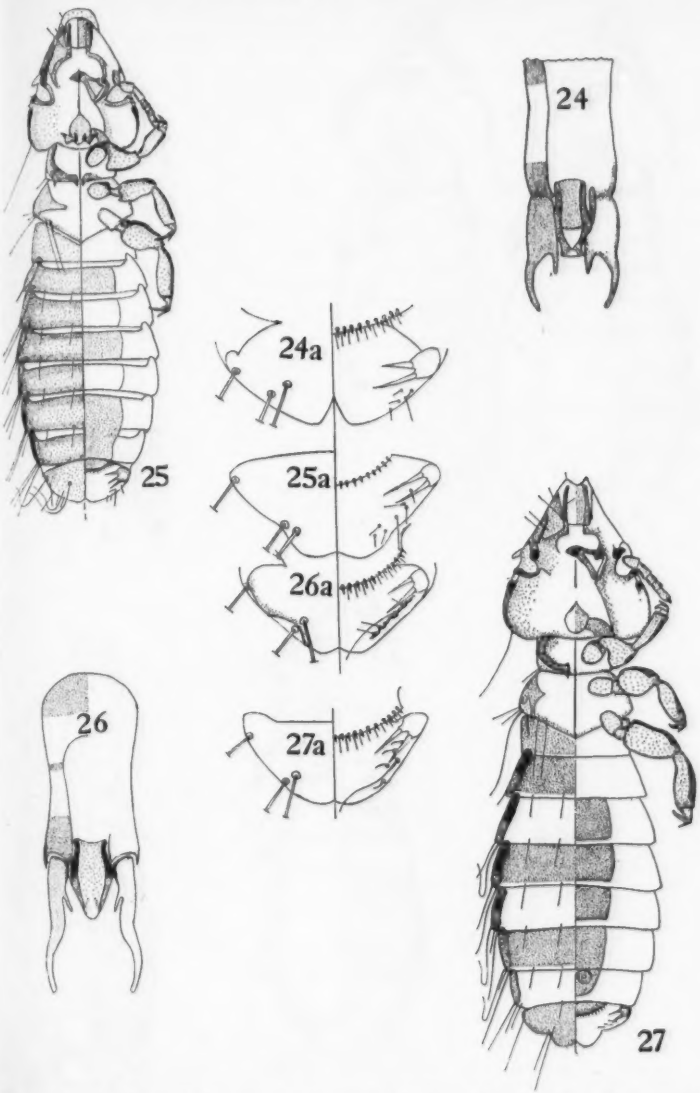
FIGURES 11–15.—*Furnaricola hirsuta hirsuta*, new species: 11, male genitalia. *F. h. picirostris*, new species: 12, male genitalia. *F. triangularis*, new species: 13, body of female; 14, male genitalia. *F. fuliginosa antioquénsis*, new subspecies: 15, head and thorax of male. FIGURES 11a–15a.—Chaetotaxy of segment VIII of females (bird hosts in parens): 11a, *F. punensis*, new species (male) (*Synallaxis cabanisi*); 12a, *F. myrmeciza*, new species (*Myrmeciza immaculata*); 13a, *F. pyriglena*, new species (*Pyriglena picea*); 14a, *F. inexpectata*, new species (*Pipra caeruleicapilla*); 15a, *F. pipraphaga*, new species (*Pipra pipra comata*).



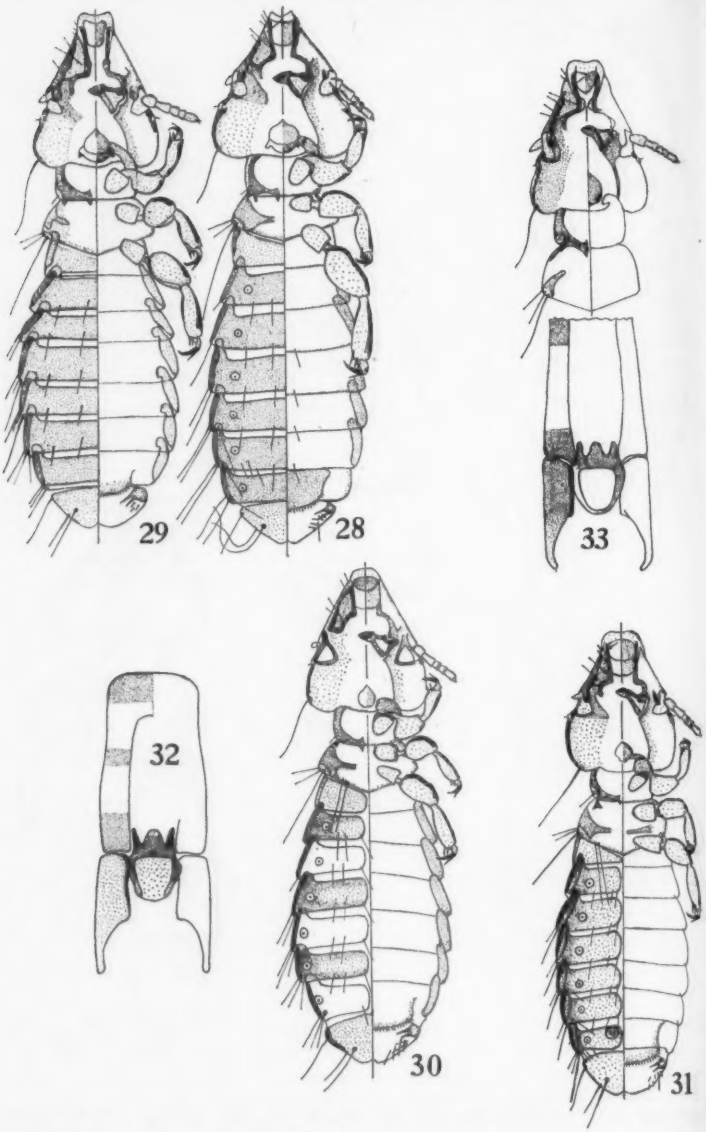
FIGURES 16–19.—*Furnaricola fuliginosa antioquénsis*, new subspecies: 16, male genitalia. *F. quadracapitis*, new species: 17, body of female. *F. anabacerthia*, new species: 18, body of female. *F. longifrons*, new species: 19, body of female. FIGURES 16a–19a.—Chaetotaxy of segment VIII of females (bird hosts in parens): 16a, *F. h. hirsuta*, new subspecies (*Xiphorhynchus picus dugandi*); 17a, *F. h. hirsuta* (*X. p. saturatior*, type host); 18a, *F. acutifrons subsimilis* Carriker (*Certhiaxis cinnamomea fuscifrons*); 19a, *F. hirsuta picirostris*, new subspecies (*Xiphorhynchus picus picirostris*).



FIGURES 20–23.—*Furnaricola longifrons*, new species: 20, male genitalia. *F. acutifrons chocoana*, new subspecies: 21, body of female; 22, male genitalia. *F. punensis*, new species: 23, body of male. FIGURES 20a–23a.—Chaetotaxy of segment VIII of females (bird hosts in parens): 20a, *F. h. hylactiphaga*, new species (*Scytalopus magellanicus affinis*); 21a, *F. h. canae*, new subspecies (*Scytalopus magellanicus canus*); 22a, *F. triangularis*, new species (*Lepidocolaptes souleyetii lineaticeps*); 23a, *F. quadraticeps*, new species (*Cichocolaptes leucophrys*).



FIGURES 24–27.—*Furnaricola punensis*, new species: 24, male genitalia. *F. myrmeciza*, new species: 25, body of female; 26, male genitalia. *F. pyriglena*, new species: 27, body of female. FIGURES 24a–27a.—Chaetotaxy of segment VIII of females (host birds in parens): 24a, *F. anabacerthia*, new species (*Anabacerthia striaticollis*); 25a, *F. longifrons*, new species (*Margarornis squamigera perlatus*); 26a, *F. acutifrons chocoana*, new subspecies (*Synallaxis albescens hypoleuca*); 27a, *F. laticephala* Carriker (*Granioleuca subcristata*).



FIGURES 28–33.—*Furnaricola pipraphaga*, new species: 28, body of female. *F. inexpectata*, new species: 29, body of female. *F. h. hylactiphaga*, new subspecies: 30, body of female. *F. h. canae*, new subspecies: 31, body of female. *F. a. acutifrons* Carriker: 32, male genitalia, from type. *F. a. subsimilis* Carriker: 33, head and thorax of female, male genitalia.

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REVISION OF CHALCID WASPS OF GENUS EURYTOMA IN AMERICA NORTH OF MEXICO

By ROBERT E. BUGBEE

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REVISION OF CHALCID WASPS OF GENUS EURYTOMA IN AMERICA NORTH OF MEXICO

By ROBERT E. BUGBEE [1]

The species of the genus *Eurytoma* Illiger, from America north of Mexico, have never been treated in a taxonomic study. The first species of the genus from the United States were described by Thomas Say in 1836, probably from specimens taken somewhere in the state of Indiana, but the type material is lost. Additional species were described by Francis Walker (1843 and 1846), Asa Fitch (1859), and Benjamin D. Walsh (1870). In 1881 William Ashmead published his first descriptions of new species of *Eurytoma* and continued to do so into the early 1900's. He was a most productive worker and in 1888 issued a revised generic table of the family Eurytomidae, designated genotypes for all genera of the family in 1894, and in 1904 published the comprehensive "Classification of the Chalcid Flies." These works, however, consisted primarily of brief descriptions and keys to the genera but did not include keys to the species. Although many of the Ashmead species are recognized today on the basis of his type

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material, some of his published descriptions are so brief and general that they could apply to many species within the genus.

In more recent years additional species have been added by A. A. Girault (1916–1920), A. B. Gahan (1922–1934), and the author of this revision (1939–), among others.

Source of Study Material

A study of several collections was made in preparation for this revision. With the aid of a grant, No. G–1308, from the National Science Foundation it was possible to spend a sabbatical year studying collections of this genus in the United States. Collections studied included those of the U.S. National Museum, Washington, D.C., Department of Agriculture, Ottawa, Canada, and Cornell University, Ithaca, N.Y. In addition, collections from the Universities of Oregon, North Dakota, Wisconsin, and Illinois, as well as my own collections, were available and contained some new species and important host and distribution data.

All available types in the United States and Canada have been examined. Type material of a number of species has been lost or destroyed. This is true for the two species described by Say (*Eurytoma studiosa* and *E. orbiculata*), three species described by Walsh (*E. gigantea*, *E. bicolor*, and *E. auriceps*), and *E. solenozopheriae* Ashmead. Neotypes are designated for these species, and *E. studiosa* and *E. auriceps* are redescribed below.

Nineteen new species are described and several species, the original descriptions of which were brief and inadequate, are redescribed.

The key to the 82 species treated in this revision is based on an unpublished one by the late A. B. Gahan, formerly of the U.S. Department of Agriculture, Division of Insects. Mr. Gahan's key was modified and enlarged considerably. The key suffices for most of the more distinct species, but for many of the species good key characteristics have been difficult to find. Experience reveals certain characteristics that may seem obvious to the worker constructing the key but which are difficult to interpret by those unfamiliar with the group. No claim is made for a completely accurate and workable key, but a first attempt must be tried at some time. It is hoped that the present key will eventually lead to the preparation of a more adequate one as weaknesses are discovered.

In the course of preparing this revision, I have received help from a number of people. Dr. B. D. Burks of the U.S. Department of Agriculture, Entomology Research Branch, Washington, D.C., and Dr. Oswald Peck, Canada Department of Agriculture, Research Branch, Ottawa, Canada, made available collections containing

Eurytoma. Both men read the manuscript and made many constructive suggestions and criticisms. Their encouragement and help are gratefully acknowledged. Dr. Henry Dietrich, Curator of Insects, Cornell University, Ithaca, N.Y., extended to me many courtesies while I studied the collection at Cornell. Frank Kurczewski and Mrs. Karlin Happe Grunau, former students at Allegheny College, prepared some of the drawings. I am also indebted to my secretary, Vanile Birkbeck, who typed the manuscript.

Systematic Treatment

In the systematic treatment the species occur in the same order as in the key. The citation of the original description in addition to important papers dealing with synonomy, host relationships, and life-history data follow. No attempt has been made to be exhaustive in the list of references, but some care has been taken to select those that seem to contain the most important information. A citation of the location of the types, type locality, distribution, and host follow in order.

The locality records for most of the species are shown on maps. The records are based on specimens that were actually seen in the various collections listed in a previous paragraph.

Host Relationships

Five orders of insects and six families of plants are represented among the hosts (see appendix). Hosts for all but 2 of the 82 species in the revision are listed but should be accepted with the reservations stated in the next paragraph. About half (33 species) of the parasitic species occur on hosts belonging to eight families of the order Hymenoptera. Coleoptera (17 species, 6 families), Diptera (7 species, 4 families), Lepidoptera (4 species, 7 families), and Homoptera (3 species, 1 family) follow in descending order. At least 12 species are phytophagous, and one of these (*Eurytoma pachyneuron*) is suspected of being both phytophagous and parasitic. The habits of the remaining species are unknown or uncertain.

Host data for many species are incomplete. In many cases the host gall from which the parasite emerged is indicated, but it cannot always be assumed that this implies a direct host-parasite relationship. In most galls there may be other primary and secondary parasites of other genera, families, or orders and often inquilines, so that unless the parasites have actually been observed to emerge from the host larvae, the exact association is unknown. Often only the plant species on which the wasp was caught or from which galls were

collected is known. The information tells nothing about actual host relationships, since most plants may have more than one species of gallmaker on them. However, some parasite-host relationships have been well established, e.g., in *Eurytoma neomexicana* Girault (Brandhorst, 1943) *E. gigantea* Walsh (Hughes, 1934 and Uhler, 1951), *E. solenozopheriae* Ashmead (Driggers, 1927), *E. pissodis* Girault (Taylor, 1929), *E. obtusiventris* Gahan (Hughes, 1934 and Uhler, 1951), *E. pini* Bugbee (Miller, 1953), and *E. bolteri* Riley (Leiby, 1922 and Barber, 1938). There are a few other species in which the evidence is quite convincing, but the number is not more than one-quarter of the species treated herein.

Several species are known to be phytophagous in such unrelated plant tissues as bulbs, stems, leaves, and buds of orchids (*E. orchidearum* (Westwood)), sumac seeds (*E. rhois* Crosby and *E. seminis* Bugbee), the fleshy parts of the fruits of juniper (*E. juniperinus* Marcovitch), the seeds of *Ceanothus divaricatus* (*E. squamosa* new species), and in the stems of certain grasses (*E. bromi* (Howard), *E. eragrostidis* (Howard)).

In at least one species, *E. pater* Phillips(=*E. pachyneuron* Girault), both phytophagy and parasitism have been suggested (Phillips, 1917). This evidence suggests that the *Eurytoma* larva begins as a parasite of the larva of *Harmolita tritici* (Fitch) in the stems of *Elymus* species, but may complete its development on plant tissue. Whether this represents a transition from parasitism to phytophagy or vica versa or simply an ability to be somewhat omnivorous in its eating habits is not clear from the evidence presented. Gahan (1922, pages 37–38) presents some arguments in favor of the first alternative mentioned.

The citation of the host applies to the type material and is taken from the original description except for specimens in which a host was not indicated. In the latter case, hosts are listed that were indicated on labels of determined specimens found in the various collections or cited in publications subsequent to the original description.

It has been impossible to check all of the names of the hosts. Several reference works, however, have been consulted often and have been most helpful. These include: "Catalogue of the Coleoptera of America North of Mexico" by Leng, published in 1920 and the supplements issued in 1927, 1933, 1939, and 1948; "Hymenoptera of America North of Mexico," 1951, by Muesebeck, Krombein, Townes and others, and the first supplement published in 1958; "Insect Pests of Farm, Garden, and Orchard" by Peairs and Davidson, 1956; "Plant Galls and Gall Makers" by Felt, 1940; "Hymenoptera of Connecticut" by Viereck, 1916.

Explanation of Terms and Measurements

Segmentation of the abdomen: Following well-established homologies the propodeum and the petiole are counted as the first two segments of the abdomen. Thus the abdomen is considered to have seven terga beyond the petiole, and the long tergum, often referred to as the fourth, will be designated in this revision as the sixth.

The ninth tergum (ninth abdominal segment) varies from elongate and pointed to very short, broad, and stubby. Laterally, on each side, is a small round cercus.

Measurements of the ninth tergum have been made from the distal tip to the proximal limit of the chitinized area or to where the intersegmental membrane begins. In all cases the insect was viewed laterally. Measurements of the length of the abdomen were made from the same lateral view, from the distal tip of the ventral valves to the proximal end of the abdomen where it joins the petiole; i.e., the petiole is not included. The length of the sixth segment was measured in lateral view from the posterior border of the fifth segment to the posterior edge of the sixth, unless otherwise stated.

Female genitalia (fig. 4): The entire genitalia were dissected from the abdomen and mounted in diaphane on glass slides. Various terms have been applied to the parts of the female genitalia of the Chalcidoidea. In this paper the following terminology is used. The dorsal valves represent the ninth abdominal tergum, which consists proximally of two parts that fuse together distally to form the exposed tip of the ninth tergum. The ventral valves, designated as the gonoplac (Scudder, 1961) or third valvula (Snodgrass, 1935), lie internal to and extend distally beyond the dorsal valves. Proximally the ventral valves expand into a broad plate that bends dorsally or, sometimes, posteriorly. The fulcral plates, called the gonangulum (Scudder, 1961) or anterior plate (Snodgrass, 1935), are two rectangular-shaped parts that articulate at their proximal ends with the dorsal extension of the ventral valves, and along their anterior ventral margin with the proximal ends of the dorsal valves. Stylet arch is formed by the bending of the stylets dorsally, posteriorly, and finally ventrally to the point where they attach to the distal end of the fulcral plates. Depending upon the degree of dorsal extension of the ventral valves, the stylet arch may be in a horizontal, oblique, or vertical plane.

Petiole: The second abdominal segment connecting the abdomen to the propodeum.

Propodeum (fig. 3): The first abdominal segment fused with the thorax (Snodgrass, 1911). Viewed from the posterior of the thorax, the propodeum in most species is concave. In the center of

the concavity may be a wide or narrow, complete or incomplete, central or median groove demarked by lateral carinae. In the median groove there may be a single central carina that divides it equally into right and left halves. The carina usually extends ventrally only one-third to one-half the length of the groove. In other species the median groove may be absent and the whole surface uniformly punctate or irregularly ridged. Lateral areas are triangular and located laterad to the lateral carinae outlining the median groove. They are usually sculptured differently from the groove. Where the median groove is present dorsally only, the lateral areas blend into the concavity of the propodeum ventrally.

Tegula (fig. 1): A small scalelike sclerite carried on the thorax at the extreme base of the forewing.

Ocellocular line: Line between the lateral margin of a lateral ocellus to the medial margin of a compound eye as seen in dorsal view of the head.

Scape (fig. 2): The proximal division of the antenna that arises from the base of the scrobe cavity, and articulates distally with the pedicle.

Flagellum: That part of the antenna distal to the ring joint. The terminal unit may consist of what appears to be two and sometimes three closely fused segments. Most often the last two are closely fused, and the preceding third segment is separated by a distinct annulation. Thus the flagellum appears seven segmented or occasionally six segmented if all three terminal units are fused. In a few species the terminal unit may be weakly enlarged to give the appearance of a subclavate condition. The remaining segments of the flagellum are truncate distally.

Marginal vein (fig. 5): Measurement of the length was made from the point at which the proximal extension of the vein is flush with the margin of the wing, distally to the point at which the postmarginal and stigmal veins diverge.

Postmarginal vein: Measured from its point of departure from the marginal vein to its distal tip.

Stigmal vein and club: Short vein that extends from the distal end of the marginal vein outward at less than a 45° angle. It ends in a small enlargement known as the stigmal club.

Forecoxa: The anterior face of the forecoxa in most species has a shallow, oblique depression. In a few species the depression is accentuated by a raised carina that makes it appear much deeper.

Umbilicate puncture: Round depression circumscribed by a raised carina with a small raised tubercle in the center. It covers the dorsum of the thorax, head, and anterior of the head.

Genus *Eurytoma* Illiger

Eurytoma Illiger, 1807a, p. 192.—1807b, p. 128.
Decatoma Spinola, 1811, p. 151.
Ennetoma Dahlbom, 1857, p. 292.
Enneatoma [sic] Dalla Torre, 1898, p. 332. [Emendation.]
Bephratella Girault, 1913, p. 95.

Type species: *Chalcis abrotani* Panzer (=*Pteromalus appendigaster*) Swederus, designated by Westwood, 1840.

FEMALE.—Varies in length from 1.5 to 7.0 mm. Color is most often black; occasionally some yellow may occur on the head, lateral prothorax and mesothorax, tegula and legs; black may be replaced by deep brown in a few species. Abdomen showing seven terga not counting the petiole and propodeum; rectangular, oval, or circular from a lateral view with slight to extreme lateral compression; ninth tergum (exposed ends of the dorsal valves of the genitalia) varies in length from .06 to .45 mm; pointed and plow shaped with a prominent cercus on each side; may be in line with the horizontal axis of the abdomen or project dorsad with the ventral valves at a 30° to 40° angle. Petiole may be longer than wide and equal in length to the hind coxae or wider than long; sixth abdominal tergum usually as long or longer than fourth and fifth combined; lateral surface of sixth often covered with fine reticulations that may fade out so that dorsal surface is smooth and shiny, or they may extend over dorsal surface.

Internal genitalia variable; in most species dorsal and ventral valves turn dorsally, anteriorly, at less than a right angle; stylet arch is in an oblique plane; dorsal extension may be so slight that stylet arch is in horizontal plane in some species while in others dorsal and ventral valves may turn dorsally at right angle, and the ventral valves turn posteriorly forming an arc of 180°, in the latter case the stylet arch is in vertical plane; width of dorsal valves may be wide for horizontal length or quite narrow and may be yellow except for posterior tip or black for entire length.

Propodeum usually concave with or without a narrow to wide median furrow; if furrow is lacking, surface often finely reticulate; if furrow is present, lateral areas often reticulate or irregularly ridged; in a few species the propodeum is rounded or sloping posteriorly, but in most species it drops sharply at almost right angles to the scutellum.

Dorsal surface of the thorax covered with umbilicate punctures; parapsidal grooves on the mesothorax usually complete; broad collar-like pronotum usually as wide or only slightly less than width of mesonotum in dorsal view; prepectus always present.

Head with occiput, frons, and genae covered with umbilicate punctures, although in a few species punctures may be reduced or

wanting, especially on frons and genae; deep scrobal cavity; a few species with prominent striae converging on clypeus from below eyes and across lower part of face.

Antenna with one ring joint; pedicle usually shorter than first funicle joint; flagellum usually with five truncate segments followed by sixth segment that is separated from the terminal unit of two closely fused segments by a distinct annulation, but never as deeply excised as the preceding five segments; flagellum usually filiform although in a few species the terminal three units may be slightly swollen or subclavate.

Foretibia with a single curved tibial spur; hindtibia with two straight tibial spurs, one slightly longer than the other; front coxa rectangular with a shallow transverse depression on anterior surface; depression may be outlined ventrally in a few species by a raised carina.

Wings clear and hyaline; forewing with a short marginal vein that may be longer than or equal in length to the postmarginal; both veins most often linear, although in a few species marginal may be broader than postmarginal and more heavily chitinized; no true stigma; stigmal vein shorter than or equal in length to marginal and ending in a small club; only other vein present is the submarginal.

MALE.—Smaller than the female, ranging from .85 to 4.2 mm. in length. Resembles the female as far as head, thorax, legs, and wing characteristics are concerned. Chief differences are in antenna and abdomen. Antenna consists of a scape with a rounded, knoblike protuberance just below articulation with petiole; flagellum with five, occasionally four, longer than wide, dorsally produced, pedicellate segments with two long whorles of hairs on two, three, and four; terminal unit of two or three closely fused segments. Abdomen with an elongate petiole, equal to or longer than hindcoxae; shape of the abdomen from the side triangular to oval; in cross section round to oval and not as long or deep as in female; sixth tergum usually the longest.

Summary of generic characteristics (female only): Small; mostly black with extremities of femur and tibia, often tegula, scape of antenna, and tips of ventral valves yellow; abdomen with seven terga; most often showing varying degrees of lateral compression; sixth tergum usually as long or longer than fourth and fifth combined and with fine scalelike sculpturing on at least lower lateral surface; ninth tergum often elongate and pointed, bearing a round cercus on each side.

Female genitalia with dorsal and ventral valves produced dorsally, anteriorly, in varying degrees so that stylet arch may be in a horizontal, oblique, or vertical plane.

Propodeum most often at approximately a right angle to the scutellum; usually shallowly concave and with or without a median furrow.

Thorax covered dorsally with coarse umbilicate punctures; parapsidal grooves on the mesonotum complete; pronotum collar-shaped and usually as long as the mesonotum; prepectus always present.

Head usually with umbilicate punctures on vertex, frons, and genae.

Antenna elbowed; scape attached at the base of a deep scrobal cavity; one small ring joint between pedicle and first joint of the flagellum; flagellum 6- or 7-segmented; if 6-segmented, terminal unit consists of three closely fused segments; otherwise two closely fused segments; antenna usually filiform or weakly clavate.

Front coxa always with a shallow oblique depression on anterior face; in a few species depression appears deeper because of a raised carina; foreleg with one curved tibial spur and hindleg with two straight tibial spurs.

REMARKS.—The description and summary of the characteristics of the genus *Eurytoma* are the author's concept of the genus, based on his knowledge of the North American species only. A revision of the genera of the family Eurytomidae on a worldwide basis might narrow or expand the limits of the genus, but as yet such a study has not appeared.

The genus is worldwide in its distribution with described species from the Arctic Circle to Patagonia and southern Africa. Although an accurate count has not been made, there must be in the neighborhood of 450 or more described species.

The author hopes that this treatment of the species of *Eurytoma* in North America north of Mexico will help increase the knowledge of this large genus and will aid those who are working with the genus in the United States and other countries, presently and in the future.

The key is restricted to the females because several species of *Eurytoma* lack males and in some others males occur sporadically in small numbers only. The species are not arranged phylogenetically although some of the more specialized morphologically appear at the beginning of the key and many of the more generalized toward the end.

Explanation of some of the structures and measurements used in the key appear in a preceding section.

Key to Species of *Eurytoma* of North America Based on Female

1. Abdominal petiole longer than wide; longer than, equal to, or only slightly shorter than the hindcoxa . . . . . .Group A. **Petiolata** (p. 442)
   Abdominal petiole short; breadth may be equal to length or greater than length . . . . . .Group B. **Brevipetiolata** (p. 443) 2

2. Head with frons, often clypeus and lateral surfaces of pronotum yellow or reddish brown . . . . . Complex I. **Bicolor** (p. 443)
Head and thorax entirely black or wholly or in part dark brown 3
3. Abdomen narrow and rectangular in lateral view; only slight lateral compression; triangular in cross section; propodeum sloping posteriorly with a deep, narrow, complete median furrow; ninth tergum and ventral valves in line with horizontal axis of abdomen . . Complex II. **Pachyneuron** (p. 444)
Abdomen and propodeum not as above 4
4. Abodmen may be strongly laterally compressed, viewed from the side elongate or broad to deeply oval; in cross section narrowly oval with greatest width in upper one-third; ovipositor may be tilted dorsad in relation to longitudinal axis of abdomen . . . . . Complex III. **Gigantea** (p. 444)
Abdomen not strongly compressed; more nearly oval in outline in lateral view and not greatly lengthened or deeply oval; ovipositor more nearly in line with longitudinal axis of abdomen.
Complex IV. **Tylodermatis** (p. 445)

Group A. Petiolata

1. Abdominal petiole longer than hindcoxa, very slender, approximately round in cross section; pronotum with 3–4 transverse ridges; abdomen extremely laterally compressed . . . . . 1. **phloeotribi** Ashmead
Abdominal petiole not longer than hindcoxa, not so slender; more nearly triangular in cross section; ridges on pronotum absent 2
2. Abdominal petiole more nearly equal in length to hindcoxa 3
Abdominal petiole distinctly shorter than hindcoxa 5
3. Face with prominent striae converging on the clypeus; abdomen elongate and laterally compressed; medium large species averaging 3.5 mm. in length; ninth tergum elongate and pointed . . . . 2. **orchidearum** (Westwood)
Face nonstriated; abdomen short and plump; small species averaging 2–2.5 mm. in length; ninth tergum short and blunt 4
4. Propodeum with a prominent tubercle, dorsally, on each side of concavity; sixth tergum sculptured over entire surface; head entirely black.
3. **mammae,** new species
Tubercles absent on propodeum; sixth tergum smooth and shining dorsally; head yellow except for black area around ocelli and occiput.
4. **lycti** Ashmead
5. Forecoxa with a prominent raised ridge on anterior face outlining a deep, rounded depression 6
Forecoxa without a prominent raised ridge on anterior face 11
6. Legs yellow or orange yellow; black infuscation when present on hindfemora only 7
Legs with black or dark-brown infuscation on femora and often on tibiae . 8
7. Anterior ocellus not separated from two lateral ocelli by distinct carinae; anterior edge of pronotum without tubercles; eyes without emargination medially . . . . . 5. **dorcaschemae** Ashmead
Anterior ocellus separated from two lateral ocelli by raised carina; two small tubercles projecting dorsally on anterior edge of pronotum; eyes with prominent emargination medially . . . 6. **semicircula,** new species
8. Propodeum with lateral areas narrow and rounded; surface covered with irregular ridges and pits; median furrow narrow and indicated by lateral carinae in dorsal half 9
Propodeum broad and concavity shallow; surface covered with fine uniform punctations; median furrow absent . . . . . 7. **profunda,** new name

9. Length of sixth abdominal tergum dorsally, approximately equal to length of fifth or at most 1½ times length of fifth; ninth tergum stout and as long or longer than eighth tergum . . . . . 8. **conica** Provancher

Length of sixth abdominal tergum, dorsally at least twice the length of fifth; ninth tergum half or less than half the length of the eighth tergum. 10

10. Central carina of median furrow present in upper half only; first joint of flagellum a third longer than second joint; stigmal club rectangular and large . . . . . 9. **magdalidis** Ashmead

Central carina of median furrow extends to base of furrow; first joint of flagellum only a sixth longer than second; stigmal club narrowly rectangular, appearing as slight enlargment of stigmal vein. 10. **inornata** Bugbee

11. Propodeum sloping; narrowly concave with a narrow and deep median furrow; abdomen rectangular, very slightly compressed 12

Propodeum vertical or abrupt; concavity wide; median furrow wide, narrow or absent; abdomen not as above 13

12. Umbilicate punctures reduced on head and thorax, very shallow and delicate; abdomen with sixth segment longer than fifth dorsally. 11. **minnesota** Girault

Umbilicate punctures not reduced, sharp and deep; abdomen with sixth segment not much longer than fifth dorsally; marginal about twice the length of the postmarginal; antenna with distinct club. 12. **illinoisensis** Girault

13. Petiole about one-half the length of hindcoxa; marginal vein broad, but not heavily chitinized . . . . . 13. **sphaera,** new species

Petiole one-half or less the length of hindcoxa; marginal vein linear; stigmal club rectangular . . . . . 14. **obtusilobae** Ashmead

Group B. Brevipetiolata

Complex I. Bicolor

1. Postmarginal vein one-half or less the length of the marginal vein . . . 2

Postmarginal vein more than one-half the length of the marginal vein . 3

2. Small species averaging 1.9 mm. in length; propodeum wide and shallow; surface finely and evenly punctate; no median furrow; all coxae yellow; venter of abdomen reddish brown . . . . . 15. **semivena** Bugbee

Medium-sized species averaging 2.9 mm. in length; propodeum wide and shallow with median furrow indicated by lateral carinae in upper half to two-thirds of length; hindcoxa often black on outer and anterior faces. 16. **flavovultus** Bugbee

3. Abdomen and thorax black; clypeus, upper part of frons, small spot behind eye, and spot on anterolateral edge of pronotum, yellow. 17. **bicolor** Walsh

Abdomen and thorax mostly deep brown; orange-yellow color on face, lateral aspect of pronotum, legs, and often coxae 4

4. Medium-sized species averaging 3.3 mm. in length; antenna distinctly clavate with a long and narrow first funicle joint, clearly longer than the pedicle . . . . . 18. **lutea,** new species

Small species averaging 2.3 mm. in length; antenna filiform; first funicle joint only slightly longer or equal to pedicle as seen from above. 19. **juniperinus** Marcovitch

Complex II. Pachyneuron

1. Marginal vein thicker and broader (2 to 3 times) than postmarginal . . 2
   Marginal vein linear or less than twice width of postmarginal; not thickened 3
2. Color deep reddish brown including mid- and hindcoxae; head and thorax with reduced umbilicate punctures . . . . . 20. **bromi** (Howard)
   Color usually black; mid- and hindcoxae yellow; head and thorax with distinct umbilicate punctures . . . . . 21. **pachyneuron** Girault
3. Body color light brown; legs and coxae yellow; sixth tergum two or more times the length of five and unsculptured laterally.
   22. **eragrostidis** (Howard)
   Body color dark reddish brown including coxae; sixth tergum about 1½ times the length of the fifth and finely sculptured laterally to dorsal surface.
   23. **neomexicana** Girault

Complex III. Gigantea

1. Abdomen in lateral view deeply oval to circular in outline; strongly compressed; ovipositor tilted dorsad so that it is transverse to the longitudinal axis of the abdomen 2
   Abdomen in lateral view elongate; if ovipositor is tilted dorsad, it is only slightly above the longitudinal axis of the abdomen 6
2. Marginal vein broad in relation to postmarginal; postmarginal half the length of marginal; prominent striae converging on the clypeus, covering lower half of face; first funicle segment twice as long as broad.
   24. **californica** Ashmead
   Marginal vein linear or nearly same width as postmarginal; the latter more than half the length of marginal; striae absent or only a few present . . 3
3. Sixth gastral tergum strongly sculptured on sides, this sculpture extending dorsally nearly or to the horizontal dorsal portion of tergum 4
   Sixth tergum smooth and polished dorsally; lateral sculpturing limited to lower two-thirds or less 5
4. Ninth gastral tergum long, its cerca located five or six times the long diameter of cercal scar from apex of tergum; margin of scrobe cavity with a distinct angle or tubercle a little above base of scape; scape, tegula, and legs black . . . . . 25. **gigantea** Walsh
   Ninth tergum much shorter, the cercal scar not more than two or three times its own length from apex of tergum; margin of scrobe cavity without angle or tubercle; scape, tegula, and legs except coxae, testaceous.
   26. **querci-globuli** (Fitch)
5. Legs with reddish-brown infuscation on femora and tibiae; propodeum with a wide incomplete median furrow that narrows ventrally.
   27. **solenozopheriae** Ashmead
   Legs with femora and tibiae yellow; propodeum with a complete, wide median furrow that maintains same width dorsoventrally . . . 28. **furva** Bugbee
6. Face clothed with dense, long, recumbent yellow hair; legs more or less reddish . . . . . 29. **pissodis** Girault
   Face clothed with less dense, recumbent silvery white hair; legs yellowish brown 7
7. Head unusually thick anteroposteriorly, anterior surface viewed in profile from above strongly convex; sixth gastral tergum laterally as well as dorsally very nearly sculptureless; legs, including anterior and midcoxae,

reddish testaceous; posterior pair sometimes with femora and tibiae infuscated . . . . . 30. **cleri** Ashmead

Head more transverse, if markedly convex anteriorly, the coxae at least are black and sixth tergum usually more strongly sculptured laterally . . 8

8. Tegula, scape, flagellum, and legs, yellow; marginal vein about three times the length of the short postmarginal vein . . . 31. **flavicrus,** new species

Tegula, often scape, flagellum, and legs, except extremities, black; marginal less than three times the length of the postmarginal vein, about 1½ . . 9

9. Average length 3.0 mm. (2.4–3.4); ninth tergum averages .22 mm. (.20–.25); sixth tergum longer than three and four combined or about one-third length of abdomen . . . . . 32. **contractura,** new species

Large species averaging about 5.0 mm. (3.7–6.6); ninth tergum averages .46 mm. (.27–.63); sixth tergum about same length as three and four combined or about one-quarter length of abdomen 10

10. Scape yellow or with slight blackish tinge dorsally only; fore- and midlegs yellowish brown; veins pale clay yellow; marginal vein thin or linear; stigmal club narrow to linear . . . . . 33. **discordans** Bugbee

Scape, femora, and tibiae of all legs usually with some black infuscation; veins yellowish brown; marginal vein narrow to broad but never linear; stigmal club rectangular to square . . . . . 34. **acuta** Bugbee

Complex IV. Tylodermatis

1. Abdomen reddish brown or at least sixth tergum reddish brown; femora and tibiae all yellow or testaceous 2

Abdomen dark brown to black 3

2. Dorsal valves of genitalia narrow for horizontal length; stylet arch and fulcral plate in a vertical plane; postmarginal vein averages about one-half the length of the marginal . . . . . 35. **prunicola** Walsh

Dorsal valves of genitalia broad for horizontal length; stylet arch and fulcral plate in an oblique plane; postmarginal vein averages about 80% length of marginal . . . . . 36. **celtigalla** Bugbee

3. Face with strong striae converging on clypeus; tegulae yellow to brown, never black 4

Face without strong, distinct, converging striae; may be a few weak striae limited mostly to lower angle of face; not covering whole lower half of face; tegula variable but most often dark brown to black 8

4. Sixth tergum long, fully 40% length of abdomen; heavily sculptured over entire surface; marginal vein linear and twice the length of the postmarginal . . . . . 37. **lacunae,** new species

Sixth tergum less than 40% length of abdomen; sculpturing limited to lower three-quarters or less of sixth tergum; marginal vein may be broader and longer than, or equal in length to postmarginal 5

5. Marginal vein equal in length to postmarginal vein; propodeum wide and shallow; median furrow indistinct or indicated dorsally only; abdomen oval and plump . . . . . 38. **nigricoxa** Provancher

Marginal vein longer than postmarginal; abdomen laterally compressed . . 6

6. Legs with black infuscation on femora and tibiae; coxae black; funicle joints of male antenna not noticeably pedicellate and lacking long whorles of hairs. . . . . 39. **querci** Fullaway

Legs all yellow, or brownish infuscation on hindfemora and tibiae only; coxae black or with some yellow on fore- and often on midcoxae; funicle joints of male pedicellate. 7

7. Ninth tergum averages .12 mm. in length; marginal vein wider than postmarginal; median furrow of propodeum indicated in upper one-third to one-half. . . . . 40. **auriceps** Walsh

Ninth tergum averages .20 mm. in length; marginal and postmarginal linear or about same width; median furrow complete to base. 41. **brevivena** Bugbee

8. Transverse carina on underside of front coxa produced into a tooth or short, blunt tubercle on outer margin. 9

Transverse carina on underside of front coxa not produced into a tooth on outer margin; carina not sharp; bordering a very shallow depression. . 10

9. Propodeum irregularly, transversely striated medially; coarsely rugose laterally; abdomen not compressed, rather blunt at apex. 42. **obtusiventris** Gahan

Propodeum within excavation, nearly uniformly alveolately sculptured; abdomen compressed, acute at apex. . . . . 43. **vernonia,** new species

10. Sixth, seventh, and eighth terga densely clothed laterally with long, white hair, continues across dorsum of seventh and eighth terga; all terga finely sculptured dorsally; face densely hairy; stigmal vein as long as marginal; postmarginal much longer than marginal. . . . 44. **bigeloviae** Ashmead

Long, dense, white hair absent on terga; sixth tergum bare, others sparsely hairy, laterally, but vestiture not long. 11

11. Pedicle, viewed dorsally, as long as the first funicle joint. 12

Pedicle distinctly shorter than the first funicle joint. 14

12. Propodeum broad and shallowly concave to almost flat; median furrow absent or indicated by wide-spaced lateral carinae in upper one-third to one-half only; rest of surface irregularly ridged and pitted or finely punctate. 13

Propodeum rounded and narrowly concave with a deep and narrow median furrow usually complete to base; head viewed dorsally, rounded anteriorly. 45. **atripes** Gahan

13. Small species averaging 1.6 mm. (1.3–1.9) in length; veins yellowish brown and linear; marginal averaging .20 mm. (.17–.25) and postmarginal averaging .10 mm. (.07–.12); thus marginal averages twice the length of postmarginal. . . . . 46. **levivultus** Bugbee

Larger species averaging 3.3 mm. (2.7–3.7) in length; veins dark brown and marginal wider than linear postmarginal; marginal only slightly longer than postmarginal; marginal averaging .11 mm. and postmarginal .10 mm. in length. . . . . 47. **tumoris** Bugbee

14. Antennal club distinctly a little thicker than the funicle. 15

Antennae filiform or without a distinct club. 16

15. Propodeum with a wide, complete median furrow that fills concavity of propodeum; lateral areas absent. . . . . 48. **fossae,** new species

Median furrow in upper one-half only or complete to base; lateral areas distinct and finely punctate. . . . . 49. **tomici** Ashmead

16. Width of malar space less than half the eye height; sixth gastral tergum very weakly sculptured at lower angles only, otherwise it is smooth; interstices between umbilicate punctures of thorax unsculptured. 50. **appendigaster** (Swederus)

Width of malar space fully half as great as eye height (frequently longer); sculpture of sixth tergum usually more extensive; interstices often sculptured 17

17. Abdomen plump; globular in lateral and dorsal view; indicating only slight lateral compression; ninth tergum short, broad, and stubby, averaging

.17–.19 mm. in length; marginal and postmarginal veins often equal in length 18

Abdomen oval, showing some lateral compression, ninth tergum variable; marginal vein usually longer than postmarginal 20

18. Abdomen lightly sculptured and limited on sixth to lower half or less; dorsal surface smooth and shiny; sixth segment narrow, averaging about 1⅗ times the length of the fifth; marginal vein longer than postmarginal . . . . . 51. **seminis** Bugbee

Abdomen more or less uniformly reticulated all over; may disappear on dorsoposterior borders of fifth and sixth tergum or cover entire surface; marginal and postmarginal veins most often equal in length; sixth tergum more nearly twice length of fifth 19

19. Propodeum broad but with a narrow, deep, complete median furrow that narrows gradually toward base . . . . . 52. **altifossa,** new species

Propodeum without a median furrow or an indication of one in dorsal one-third only . . . . . 53. **crassa,** new species

20. Sculpturing on sixth abdominal tergum heavy ventrally and extending over dorsal surface, either covering entire surface or forming a narrow band along anterior margin 21

Sculpturing on sixth tergum reduced to lower half to one-third or less of surface; dorsal surface smooth and shiny 30

21. Sixth tergum completely covered with fine reticulations; heavy ventrally, becoming lighter dorsally; dorsal valves broad for horizontal length. 54. **terrea** Bugbee

Sixth tergum with closely spaced heavy reticulations ventrally that become lighter dorsally and recede toward anterior margin in the form of a narrow band 22

22. Propodeum with a narrow or wide complete median furrow 23

Propodeum with an incomplete median furrow restricted to upper half or less 26

23. Dorsal valves narrow for horizontal length 24

Dorsal valves broad for horizontal length 25

24. Ninth tergum elongate and pointed, averaging .29 mm. in length (.20–.35); antenna filiform . . . . . 55. **incerta** Fullaway

Ninth tergum short and broad, averaging .16 mm. in length (.13–.19); antenna weakly clavate . . . . . 56. **stigmi** Ashmead

25. Genitalia averages 2.1 mm. in length and .81 mm. in height; median groove with a median carina complete to base; ocellocular line about twice diameter of lateral ocellus . . . . . 57. **sciromatis** Bugbee

Genitalia averages 1.5 mm. in length (1.4–1.8) and .75 mm. in height (.62–.87); thus the height is about half the length; stylet arch nearer to horizontal plane than an oblique plane; ocellocular line less than twice the diameter of the lateral ocellus . . . . . 58. **tylodermatis** Ashmead

26. Dorsal valves of female genitalia broad for horizontal length 27

Dorsal valves narrow for horizontal length 29

27. Legs with reddish-brown to black infuscation on fore- and hindfemora, rest of legs yellow; dorsal valves of female genitalia broad for horizontal length; marginal and postmarginal most often equal in length, averaging .29 mm. (.25–.35); marginal vein linear . . . . 59. **gossypii,** new species

Legs with black or dark-brown infuscation on femora and tibiae of all legs or lacking on foretibia only; marginal vein broader than postmarginal vein 28

28. Propodeum with an incomplete median furrow; area below furrow and lateral areas finely and evenly punctate. Internal genitalia short; length equal to twice the height; stylet arch in a horizontal plane. 60. **squamosa,** new species

Propodeum with a wide, shallow, complete median furrow that narrows ventrally; furrow crossed by irregular horizontal ridges; lateral areas roughly ridged and punctate. Internal genitalia with length less than twice the height and stylet arch in an oblique plane . 61. **calycis** Bugbee

29. Size large, averaging 4.5 mm. (3.9–5.2) in length; ninth tergum elongate averaging .28 mm. in length (.25–.32); marginal and postmarginal veins often equal in length . . . . . 62. **pini** Bugbee

Size medium, averaging 3.2 mm. (3.0–3.7) in length; ninth tergum averaging .20 mm. (.17–.22) in length; marginal usually longer than postmarginal. 63. **baccae,** new species

30. Ninth abdominal segment short and blunt, averaging less than 0.20 mm. in length (range .10–.19) 31

Ninth abdominal segment more elongate and acutely pointed, averaging 0.20 mm. or more in length (range .23–.29) 42

31. Median furrow of propodeum wide and indicated by lateral carinae in upper one-third to one-half only, or may be absent 32

Median furrow complete to base of propodeum and limited laterally by complete lateral carinae 38

32. Abdomen quite plump, only slight lateral compression; marginal vein longer than postmarginal vein; ninth tergum very short and stubby averaging less than .10 mm. in length . . . . . 64. **rhois** Crosby

Abdomen compressed but not extremely so; marginal vein often equal in length to postmarginal; ninth tergum more elongate, averaging .10 mm. or more in length 33

33. Legs with a black to dark reddish-brown infuscation on all femora and tibiae; coxae usually black 34

Legs all yellow or black to dark-brown infuscation on hind- and midlegs only; coxae may be yellow or black 37

34. Color dark brown to black; marginal vein broader than postmarginal; tegula and scape yellow to brown 35

Color black, marginal vein linear or about same width as postmarginal; tegula and scape most often black or dark brown 36

35. Marginal and postmarginal veins most often equal in length; antenna filiform; dorsal valves of genitalia narrow for horizontal length and stylet arch in an oblique plane . . . . . 65. **levo,** new species

Marginal vein always longer than postmarginal vein; antenna subclavate; dorsal valves broad for horizontal length and stylet arch in a horizontal plane . . . . . 66. **crassineura** Ashmead

36. Propodeum with a median furrow that is wide at top but narrows ventrally; lateral and central carinae distinct in upper one-half to three-quarters; first funicle joint narrow and elongate . . . . . 67. **parva** Phillips

Propodeum flat and without a median furrow; surface finely punctate; first funicle joint longer than wide but not noticeably thin and elongate. 68. **fusca,** new species

37. Legs with black or brown infuscation on hindfemora and tibiae and occasionally on midfemora and tibiae; marginal vein stout or broader than postmarginal vein. Ninth tergum short, averaging .15 mm. in length (.12–.17) . . . . . 69. **iniquus** Bugbee

Legs all yellow often including front and midcoxae; marginal vein linear; ninth abdominal tergum short, averaging .19 mm. in length (.17–.20). 70. **flavicrurensa** Bugbee

38. Postmarginal vein averages 70–72% the length of marginal vein; dorsal valves narrow to medium 39
Postmarginal vein averages 80% or better the length of marginal vein; dorsal valves of female genitalia wide for horizontal length 40

39. Marginal vein long, averaging .42 mm. (.35–.45) in length; tegula black. 71. **longavena** Bugbee
Marginal vein short, averaging .29 mm. (.25–.37) in length; tegula black or dark brown . . . . . 72. **studiosa** Say

40. Ninth abdominal tergum short and blunt, averaging .10–.13 mm. in length (.07–.15) 41
Ninth abdominal tergum short, averaging .15 mm. or more in length (.10–.22). 73. **spongiosa** Bugbee

41. Sixth abdominal tergum about as long as four and five combined; median furrow of propodeum narrows toward base . . . 74. **obtusa,** new species
Sixth abdominal tergum narrow, very little longer than fifth; median furrow with approximately parallel lateral carinae . . . 75. **imminuta** Bugbee

42. Ocellocular line distinctly longer (approximately twice) than diameter of lateral ocellus . . . . . 76. **bolteri** Riley
Ocellocular line subequal (less than twice; more nearly equal) to diameter of lateral ocellus 43

43. Dorsal valves of the female genitalia broad for horizontal length; propodeum with a narrow median furrow outlined by lateral carinae to base of propodeum; tegula black . . . . . 77. **spina** Bugbee
Dorsal valves of female genitalia narrow for horizontal length and only slight dorsal extension of dorsal and ventral valves; propodeum variable, wide, and shallow without median furrow or incomplete median furrow 44

44. Marginal vein broader than postmarginal vein; all veins brown 45
Marginal vein linear and about same width as postmarginal; veins pale yellow 46

45. Sculpturing on lateral surface of sixth tergum limited to lower half or less; dorsal surface smooth and shiny; femora and tibiae with black infuscation. 78. **picea,** new species
Sculpturing on sixth covers most of lateral surface but may disappear or continue over dorsal surface; femora and tibiae often yellow or with some brown infuscation . . . . . 79. **calcarea** Bugbee

46. Basic color of legs yellow with varying amounts of black or dark-brown infuscation on middle and hindtibia and femora; marginal vein longer than postmarginal vein 47
Basic color of legs orange-brown with brown infuscation on hindfemora in some specimens; marginal and postmarginal veins equal in length. 80. **apiculae** Bugbee

47. Legs yellow except for black or reddish-brown infuscation on hindfemora only; sculpturing on lateral aspect of sixth abdominal tergum limited to lower half . . . . . 81. **mali,** new species
Forelegs often yellow or with black infuscation on femora; black infuscation on mid- and hindfemora and tibiae; lateral sculpturing on sixth abdominal tergum usually covers lower half completely and then diminishes toward anterior margin to just below dorsal surface . . . 82. **diastrophi** Walsh

Group A. Petiolata

1. *Eurytoma phloeotribi* Ashmead

MAP 1

Eurytoma phloeotribi Ashmead, 1894, p. 326.—Peck, 1951, p. 577.

Types: U.S. National Museum, no. 25505; type series consists of 6 females, 1 of which I have labelled and designated as lectotype.

Type locality: Morgantown, W. Va., bred Mar. 23, 1893, by A. D. Hopkins, Acc. no. 6117a, from Mulberry.

Distribution: United States: West Virginia, Virginia, Washington, D.C., North Carolina, New York, Oregon, California, Idaho. Canada: Quebec.

Hosts: *Phloeotribus frontalis* (Oliver) *in* Mulberry (Ashmead, 1894). *Phloeotribus dentifrons* (Blackman) (Peck, 1951, *in* Musebeck et al., U.S. Dept. Agric. Monogr., no. 2). *Pityophthorus liquidambarus* Blackman (Peck, 1951, *in* Musebeck et al., U.S. Dept. Agric. Monogr. no. 2). *Pseudopityophthorus minutissimus* (Zimmermann) (Peck, 1951, *in* Musebeck et al., U.S. Dept. Agric. Monogr., no. 2). *Pseudopityophthorus pruinosus* (Eichhoff) (Peck, 1951, *in* Musebeck et al., U.S. Dept. Agric. Monogr., no. 2). *Scolytus muticus* Say (Peck, 1951, *in* Musebeck et al., U.S. Dept. Agric. Monogr., no. 2). *Stephanoderes dissimilis* (Zimmermann) (Peck, 1951, *in* Musebeck et al., U.S. Dept. Agric. Monogr., no. 2). *Scolytus abietis* Blackman from *Abies grandis* (specimens in U.S. National Museum collection).

Additional locality records and specimens: U.S. National Museum collection (22 females and 11 males).

This species seems to be limited in its parasitism to the Engraver beetles of the family Scolytidae.

Eurytoma phloeotribi with its abdomen extremely compressed laterally, round elongate petiole, and coiled female genitalia might well be separated from *Eurytoma* as a distinct genus. Since only the one species is known, and there are only a few specimens, it seems best to leave it in *Eurytoma* until more study material is available.

2. *Eurytoma orchidearum* (Westwood)

Isosoma orchidearum Westwood, 1869, p. 1230; 1882, pp. 307–328.—Moore, 1916, pp. 3–12.—Felt, 1916, p. 336.
Eurytoma orchidearum Gahan, 1922, p. 41.—Peck, 1951, p. 577.
Eurytoma phoenix Girault, 1917, p. 11; 1920, p. 204.—Bugbee, 1956, p. 504.

Types: Hope Department of Entomology, University Museum, Oxford, England.

Type locality: Brazil.

Distribution: Cosmopolitan.

Host: Orchids (*Cattleya* species).

Remarks: *E. orchidearum* (Westwood) occurs wherever orchids are grown and shipped. It first appeared in the United States in Natick, Mass. in 1889 (Felt, 1916). It is phytophagous in the bulbs, stems, buds, and leaves of many orchid species. An account of its biology is given by Moore (1916). See Bugbee (1956) for taxonomic notes. This species lacks the raised carinae bordering a deep depression on the anterior face of the forecoxae, and the propodeum has a deep median furrow with raised lateral carinae, especially prominent at the base.

3. *Eurytoma mammae*, new species

FIGURE 10; MAP 2

Female: Mostly black. Average length 2.3 mm. (1.8–2.7). Abdomen bluntly oval in lateral view and approximately equal in length to the head and thorax combined; length not including the petiole averages 1.0 mm. (.82–1.2); surface of sixth tergum of the abdomen covered entirely with fine scalelike sculpturing that becomes more delicate over dorsal surface. Ninth tergum short, blunt, and about equal in length to the eighth tergum; averages .07 mm. (.05–.10) in length. Internal genitalia average 1.1 mm. in length; dorsal valves broad for horizontal length and turn dorsally, anteriorly along with ventral valves at less than a right angle; stylet arch close to a horizontal plane; dorsal valves black at distal tip, remainder yellow; distal tip of ventral valves extends only slightly beyond tip of dorsal valves. Petiole longer than wide, and about two-thirds the length of hindcoxae; flattened dorsally and without a median, dorsally produced scale at anterior end. Propodeum broad and shallowly concave; surface finely punctate except dorsally and sometimes a narrow strip down middle that may be irregularly ridged; carina outlining dorsal margin of concavity slanting ventrolaterally and produced into a posteriorly directed, sharp tubercle on each side before it bends ventromedially; area lateral to carina, including sides of propodeum, punctate. Tegulae yellow. Pronotum flattened dorsally. Eyes, scrobe cavity, and clypeus emarginate. Antenna with yellow scape and pedicle; flagellum brown and six jointed, first segment longer than wide, two to five moniliform. Legs with dark-brown infuscation on femora only, except for midfemora that may lack it; tibiae yellow; forecoxae with an oblique raised carina on anterior face below a deep depression. Wing veins yellow; marginal and postmarginal linear; stigmal vein short; club narrow and rectangular; marginal longer than postmarginal vein, averaging .22 mm. (.20–.25) and .13 mm. (.10–.15) respectively.

Male: Unknown.

Types: 9 females. Holotype female and paratypes in the U.S. National Museum collection, Washington, D.C. (USNM 66051). Paratypes in the Bugbee collection, Meadville, Pa.

Type locality: Arlington, Va., May 30, 1958, K. V. Krombein collection. Paratypes collected June 4, July 3 and 6, 1955; May 26, 1957, by K. V. Krombein.

Host: Unknown for the type series. Possibly *Stigmus* species and *Leperisinus aculeatus* (Say).

Distribution: United States: Virginia, New Jersey, Maryland, and Illinois.

Remarks: This species is close to *Eurytoma lycti* Ashmead but can be separated from it by the more extensive sculpturing that covers the dorsal surface of the sixth abdominal tergum, the tubercles on the propodeum, and the lack of any yellow on the head.

4. *Eurytoma lycti* Ashmead

MAP 2

Eurytoma lycti Ashmead, 1894, p. 325.—Elliott and Marley, 1911, pp. 452–496.—Peck, 1951, p. 576.

Types: U.S. National Museum, no. 11869. Type material consists of 1 female which I have labeled and designated as type.

Type locality: Morgantown, W. Va., bred Sept. 10, 1893, by A. D. Hopkins.

Distribution: United States: Virginia, West Virginia, Kansas.

Host: *Lyctus striatus* Melsh in Hickory (Ashmead, 1894).

Remarks: The only host record for this species is *Lyctus striatus* Melsh, nesting in Hickory, cited in the original description by Ashmead (1894). It is probably rather widely distributed as the lone specimen from Riley County, Kansas, suggests.

This species is distinguished by the presence on the propodeum of a very narrow but quite deep median furrow, the absence of a thin scale on the dorsal surface at the anterior end of the petiole, and a raised obtuse tubercle, and the absence of distinct, complete parapsidal grooves on the mesonotum.

5. *Eurytoma dorcaschemae* Ashmead

MAPS 5, 35

Eurytoma dorcaschemae Ashmead, 1888, p. 2, appendix.—Peck, 1951, p. 576.
Eurytoma dorchasemi Bridwell, 1899, pp. 203–211. [Emendation.]

Types: U.S. National Museum no. 11908. Type series consists of 2 females and 2 males and I have labelled and designated 1 female specimen as lectotype.

Type locality: Riley County, Kans. Marlatt collection, Sept., 718, 719.

Distribution: United States: Kansas, North Carolina, New Jersey. Canada: Saskatchewan.

Hosts: *Dorcaschema alternatum* (Say) (Ashmead, 1888). *Phloeotribus frontalis* (Oliver) (Peck, 1951, *in* Muesebeck et al., U.S. Dept. Agric. Monogr., no. 2).

Remarks: This species is similar to *E. conica* Provancher but differs from it in the yellow legs without dark brown to black infuscation on femora and tibiae.

The two female specimens from White Fox, Saskatchewan, Canada, differ slightly from the type female, but because of the all-yellow legs and only two specimens for comparison, it seems best to include them with *E. dorcaschemae*.

The scanty host data suggest that the species is parasitic on wood-boring beetles belonging to the families Cerambycidae and Scolytidae.

6. *Eurytoma semicircula*, new species

FIGURES 12, 22; MAP 3

Female: Black. Averages 4.5 mm. (4.3–4.8) in length. Abdomen averages 2.0 mm. (2.0–2.2) in length; oval in lateral view; sculpturing on lateral aspect of sixth tergum heavy ventrally but extends only to about middle of surface so that dorsal surface is smooth and shiny; sixth tergum longer than three and four combined; ninth tergum short and stubby, averages .15 mm. (.12–.17) in length. Internal genitalia averages 2.0 mm. in length and .50 mm. in height; height equal to one-quarter the length; dorsal valves black and wide for horizontal length; dorsal and ventral valves turn dorsally, anteriorly, only slightly so that stylet arch is in a horizontal plane. Petiole longer than wide and about half the length of the hindcoxa; anterior end of petiole with a flat, rounded, dorsally projecting scale flanked on each side by a bluntly pointed, dorsolaterally, projecting tubercle. Propodeum with a narrow concavity; median furrow dorsally, with one large or two round or slightly oval depressions with shiny surfaces, followed below by a single row of round, shiny-surfaced depressions that may be smaller toward base; lateral areas finely and evenly punctate. Tegula black. Prothorax with two dorsally projecting tubercles on anterior border, one on each side of middorsal line. Median ocellus separated from two lateral ocelli by a raised, curved carina. Compound eyes with a prominent carina along medial margin. Short hairs on face may have a golden tinge. Antennae filiform; joints longer than wide; first funicle joint about twice the length of the pedicle; scape with outer face orange brown. Legs with the coxae black; front coxae with a prominent, flared carina on anterior face running diagonally from the upper, outer margin to medial margin; rest of legs orange brown, except hindfemora which may have some black infuscation medially on outer surfaces. Wing veins straw yellow to light brown in color; linear; marginal averages

.29 mm. (.27–.32) and postmarginal averages .25 mm. (.25–.27) in length.

Male: There are no males in the type series.

Types: 4 females. Holotype female and paratypes in the U.S. National Museum collection, Washington, D.C. (USNM 66052). Paratype female in the Bugbee collection, Meadville, Pa.

Type locality: southwest Hidalgo County, Tex. Collected Jan. 1, 1947, by G. B. Vogt.

Host: Reared from larvae of *Leptostylus gibbulosus* in fruit of *Sapindus drummondii* in March 1947.

Distribution: Known only from the type locality in Texas.

Remarks: The new species is close to the *E. conica*, *E. profunda*, and *E. dorcaschemae* group of species. It can be separated from them by the curved carina between the front and the two lateral ocelli, the emarginated eyes, the slightly raised tubercles on the anterior border of the prothorax, and the orange-brown color of the legs and scape.

7. *Eurytoma profunda* Bugbee, new name

MAP 3

Decatoma maculipes Ashmead, 1886, p. 126.
Eurytoma maculipes Ashmead, 1887, p. 195.—Peck, 1951, p. 576.

This new name with its redescription is presented for *Eurytoma maculipes* (Ashmead) 1887 not *Eurytoma maculipes* Motschulsky 1863.

Female: Black. Average length 3.7 mm. (3.0–4.1); abdomen averages in length 1.8 mm. (1.4–1.9); long sixth segment averages .73 mm. (.62–.80); thus the sixth is about 40% of the length of the abdomen; fine scaling on sixth segment covers lower ⅓ to ¾ of lateral surface; heavy ventrally but becomes lighter and recedes toward anterior margin dorsally; dorsal valves (9th tergum) short and stubby; averages .16 mm. in length (.15–.17); abdominal petiole longer than is typical of the genus, averages .12 mm. (.10–.15); prominent dorsally projecting scale or node anteriorly where petiole joins the propodeum; periole length equal to about one-quarter the length of the hindcoxae which averages .42 mm. in length (.35–.45). Internal genitalia with wide, stout dorsal valves with only slight dorsal curvature anteriorly; ventral valves bend dorsally, anteriorly, but extend only slightly above dorsal valves; stylet arch in a horizontal plane; length of genitalia averages 1.5 mm. (1.6–1.7); height averages .78 mm.; whole structure appears weakly developed with slight dorsal development, anteriorly. Propodeum wide and deeply concave; entire surface may be covered with fine uniform punctations or indication of median furrow that is wide at top but narrows abruptly and disappears in lower half.

Antenna short and stocky; scape yellow; flagellum including pedicel averages 1.0 mm. in length; first segment longer than wide; two to five becoming progressively shorter until four and five are approximately square; segments not moniliform but sharply truncate at distal ends; slightly swollen terminal unit composed of three closely fused segments; legs with the coxae black; dark brown to black on all femora; knees yellow; foretibiae may be yellowish brown or show dark-brown infuscation medially; dark brown to black infuscation on mid- and hindtibiae medially; forecoxae with a pronounced, semicircular, horizontal, carinated ridge about middle of anterior face in contrast to the usual shallow, rounded oblique depression characteristic of most species of the genus. Wing veins light yellow and thin; marginal vein averages .35 mm. in length (.30–.37) and postmarginal .24 mm. (.22–.25).

Male: Average length 3.3 mm. (3.2–3.4). Scape of antenna black; first 4 segments of flagellum, pedicellate distally, dorsally raised, and center slightly constricted; fifth segment not pedicellate distally but separated from terminal segments by a deep annulation; pointed terminal unit composed of two closely fused segments. Legs with black to dark brown on all femora and tibiae; knees yellowish brown. Marginal and postmarginal veins linear; marginal averages .33 mm. (.30–.35) in length and shorter postmarginal .23 mm. (.20–.27).

Types: Holotype female in the U.S. National Museum, no. 25506, Washington, D.C.

Type locality: Holotype locality, Jacksonville, Fla., bred April 1885.

Hosts: Specimens were bred from *Iva ciliata*, *Ambrosia trifida*, and *Solanum rostratum* stems. No insect host species stated. Holotype female from gall of *Dryorhizoxenus floridanus* Ashmead (Ashmead, 1886).

Distribution: Known so far only from central and southern Texas and Jacksonville, Fla.

Remarks: The redescription was based on the holotype female and the specimens listed above. The prominent raised almost horizontal carinated ridge on the forecoxae, the elongate petiole, the wide and shallow propodeum with the surface finely punctate, and the very long sixth abdominal segment make this species easily recognizable.

The host of this species was not given for any of the specimens in the series listed above. However, parasites determined as *Eurytoma tylodermatis* are recorded from weevil larvae (*Trichobaris texana*) in the stems of *Solanum rostratum* (Pierce 1908a, and Pierce, Cushman, and Hood, 1912), (*Lixus scrobicollis*) in *Ambrosia trifida* (ibid, and Pierce 1908b), and (*Trichobaris trinotata*) from stems of *Solanum*

carolinese (Chittenden, 1911). It is possible that one or more of the aforementioned weevils might serve as host for this species.

Dalla Torre (1898, p. 339) proposed the name *Eurytoma maculitarsis* for *Eurytoma maculipes* of Motschulsky when it should have been proposed for Ashmead's species. Since Dalla Torre did not accompany his proposal with a description and Motschulsky's species is still good, *Eurytoma maculitarsis* of Dalla Torre is a nomen nudum.

Decatoma (=*Eurytoma*) *maculipes* (Ashmead, 1886 and 1887) is preoccupied by *E. maculipes* of Motschulsky 1863.

I have hesitated to propose a new name for *E. maculipes* of Ashmead 1887, since I have not seen the type material of *E. maculipes* of Motschulsky 1863. However, since the species described by Motschulsky came from Ceylon and the species of Ashmead came from Florida, the chances of the two being the same are very remote; therefore, the new name is proposed for Ashmead's species.

8. *Eurytoma conica* Provancher

FIGURE 9; MAP 3

Eurytoma conica Provancher, 1887, pp. 192, 193.—Peck, 1951, p. 576.—Bugbee, 1956, p. 504.
Isosoma abnorme Ashmead, 1896, p. 219.
Harmolita abnorme Phillips and Emery, 1919, pp. 436, 468.
Eurytoma abnorme Hoffmann, 1942, p. 19.
Eurytoma abnormis Bugbee, 1956, p. 504.
Eurytoma phloeosini Ashmead, 1894, p. 327.—Bugbee, 1956, p. 504.

Types: Department of Agriculture, Ottawa, Canada: 1 female lectotype (see Bugbee, 1956).

Type locality: Ottawa, Canada.

Distribution: Canada: Quebec, Ontario, British Columbia. United States: Illinois, California, North Carolina, New York, Connecticut, Kansas, Massachusetts, New Jersey, Indiana, Oregon, West Virginia, Texas.

Hosts: *Dendroctonus frontalis* Zimmerman in *Pinus echinata* (specimens in U.S. National Museum collection). *Pissodes strobi* (Peck) (specimens in Dept. Agric. collection, Ottawa, Canada and U.S. National Museum collection). *Cylindrocopturus longulus* (LeConte) (U.S. National Museum collection). *Dendroctonus brevicomis* LeConte (Bugbee collection).

Remarks: *Eurytoma conica* can be easily confused with *E. dorcaschemae*. The most consistent difference between the two is the presence in the former species of deep brown to black infuscation on all femora and tibiae in contrast to the all-yellow legs in the latter.

The hosts of this species are chiefly members of the family Scolytidae. For notes on synonymy, see Bugbee (1956).

9. *Eurytoma magdalidis* Ashmead

MAP 4

Eurytoma magdalidis Ashmead, 1894, p. 326.—Beal and Massey, 1942, pp. 316–318.—Hoffmann, 1942, p. 19.—Peck, 1951, p. 577.

Types: U.S. National Museum no. 11868; type series consists of 2 females, 1 of which, with the accession number 60586, I have labelled and designated lectotype.

Type locality: Morgantown, W. Va., bred by A. D. Hopkins, Acc. no. 6058b.

Distribution: United States: West Virginia, North Carolina, New York, Kansas, California. Canada: Quebec, Ontario, Manitoba.

Hosts: *Magdalis armicollis* Say, in elm (Ashmead, 1894). *Oncideres cingulatus* (Say), on hickory (hickory twig girdler) (Beal and Massey, 1942). *Anthribus cornutus* Say (U.S. National Museum collection). *Cylindrocopturus longulus* (LeConte) on *Pinus* sp. (U.S. National Museum collection).

Remarks: *E. magdalidis* Ashmead with its dark legs, rounded, narrow propodeum, long sixth abdominal segment, and generally smaller dimensions seems to be distinct from the preceding species. Its hosts belong to families of beetles whose larvae bore in plant tissue.

10. *Eurytoma inornata* Bugbee

Eurytoma inornata Bugbee, 1962, pp. 347–348.

Type: 3 females and 1 male. Holotype female emerged Mar. 27, 1962, from nest number 92361F, cell 1, K. V. Krombein collection. Two paratype females emerged Mar. 22 and 24, 1962, from nest number 92361B, cell 1 and nest number 92361F, cell 4. The single male emerged Mar. 22, 1962, from nest number 92361F, cell 3, K. V. Krombein collection. Holotype in the U.S. National Museum, Washington, D.C. Paratypes in the Bugbee collection, Allegheny College, Meadville, Pa.

Type locality: Plummers Island, Md.

Host: Believed to be *Euplilis rufigaster* (Packard), nesting in hibiscus stems.

Distribution: Maryland.

Additional specimens: Plummers Island, Md., collected July 22, 1962, by K. V. Krombein, 1 female; collected near Plummers Island, Md., Sept. 9, 1962, by K. V. Krombein and bred from cacoon of *Euplilis* sp., 1 female; Plummers Island, Md., collected Sept. 10, 1962, by K. V. Krombein and bred from cacoon of *Trypoxylon* species, 1 female.

Remarks: See Bugbee 1962.

11. *Eurytoma minnesotae* Girault

MAP 4

Eurytoma minnesota Girault, 1916, p. 338.
Eurytoma minnesotae Peck, 1951, p. 577.

Types: U.S. National Museum, no. 20322, 5 females and 2 males.

Type locality: Olmsted, Minn., reared from Quack grass, 1906, Ainslie collection.

Distribution: United States: Minnesota.

Host: *Agropyron* (Quackgrass sp.) (Girault, 1916).

Remarks: Additional specimens of *E. minnesotae* were not found in any of the collections examined. It seems to be a valid species, however, as the elongate petiole will separate it from any of the other species bred from Quackgrass, such as *E. pachyneuron* Girault. The small size, absence of a flared carina on the anterior surface of the front coxae, and the rounded narrow propodeum with a narrow and deep, complete, median furrow, will also help to distinguish *E. minnesotae*.

12. *Eurytoma illinoisensis* Girault

MAP 5

Eurytoma illinoisensis Girault, 1920, p. 206.—Peck, 1951, p. 576.

Types: U.S. National Museum, no. 20629, 2 females.

Type locality: Urbana, Ill. Reared in connection with *Isosoma*=(*Harmolita*).

Distribution: United States: Illinois, South Dakota, New Mexico, Wisconsin, and Iowa. Canada: Quebec, Ontario, Nova Scotia.

Host: Reared in connection with *Isosoma* (Girault, 1920). *Elymus* species (Girault, 1920). *Stipa columbiana*, *Vicia villosa*, *V. angustifolia*, and *V. americana* (Bugbee collection).

Remarks: The material included under *E. illinoisensis* Girault is a mixture of what may be more than one species. Unfortunately, good representative series from more than one locality were not encountered in this study. One or two specimens, often without host data, from a few scattered localities, are not enough to give an adequate picture of the variation of a species.

The rectangular-shaped abdomen with the narrow sixth abdominal tergum that is about equal in length to the fifth, the rounded propodeum with a deep and narrow concavity, and the obviously clavate, elongate antennae are characteristics of this species.

13. *Eurytoma sphaera*, new species

FIGURE 17; MAP 6

Female: Black. Average length 2.9 mm. (2.6–3.2). Abdomen plump, globular, or approximately round in outline from a lateral

view; averages 1.3 mm. (1.2–1.5) in length; sculpturing heavy on lateral surface of sixth, but disappears dorsally; segment six from a dorsal view as long or longer than segments five and six combined; ninth tergum short and stubby, averaging .09 mm. (.07–.12) in length with a small oval cercus on each side. Internal genitalia with broad dorsal valves for horizontal length and very little dorsal extension anteriorly; arch of the stylets in a horizontal to an oblique plane; length of genitalia averages 1.3 mm. (1.1–1.5) and height averages .88 mm. (.72–1.1); length thus about 1.7 times the height. Petiole elongate; less than half the length of hindcoxa; a prominent pointed scale on dorsal anterior surface, a small lateral projecting tubercle on each side. Tegula yellow to dark brown. Propodeum with a shallow concavity with a distinct median furrow demarked by lateral carinae complete to base and a central carina for three-quarters of length; furrow narrows toward base; lateral areas finely punctate ventrally and irregularly ridged dorsally. Antenna filiform; scape yellowish brown; flagellum six segmented; joints longer than wide but becoming progressively less so from base to tip; last segment consisting of three closely fused units. Fine striae on face converging on clypeus from below eyes and base of antennae. Legs may be all yellowish brown or black smudge on middle of outer face of front femora and tibiae; black infuscation encircling mid- and hindfemora and tibiae; front coxae may be yellow or all black. Wing veins yellowish brown to brown; marginal stout and broad but not heavily chitinized; postmarginal short, stout, and truncate at outer end; marginal averages .30 mm. (.25–.35) and postmarginal averages .20 mm. (.17–.25); marginal vein always longer than postmarginal by about .10 mm.; stigmal vein short; club large and almost square.

Males: Black. Average length, 2.9 mm. (2.2–3.3). Scape of antenna yellowish brown or upper one-third black and rest yellowish brown. Legs all yellowish brown or hindfemora and sometimes hindtibiae may have a brown to black smudge medially on outer surface; front coxae as in the female; midcoxae may be all yellow. Wing veins yellowish brown to dark brown. Marginal averages .29 mm. (.27–.35) and postmarginal averages .19 mm. (.15–.22).

Types: 56 females and 63 males. Holotype female, allotype male, and paratypes in the U.S. National Museum collection (USNM 66053).

Type locality: Wyatt, La., Oct. 31, 1934, Kinsey collection. Emerged from June 14 to 30, 1935.

Host: *Disholcaspis spongiosa* (Karsch) and *D. quercus-globulus* (Fitch) on *Quercus stellata*, Kinsey collected and determined.

Distribution: Southern Ohio and Illinois, south to the Gulf of Mexico: east to the Atlantic coast and west to eastern Texas and Missouri. This species seems to follow the coastal plain, extending

northward through the Mississippi River Valley and then spreading eastward and westward by way of its main tributaries, such as the Tennessee, Ohio, and Missouri. This suggests that the species may be found also even farther north, wherever its hosts occur.

Remarks: *E. sphaera* and *E. obtusiloba* Ashmead are closely related but *E. sphaera* has a longer petiole, averaging about half the length of the hindcoxae, in contrast to *E. obtusiloba* where the petiole averages nearer one-fourth the length of the hindcoxae. In addition, the marginal vein is broader, and also longer in relation to the postmarginal; the stigmal club is larger than in *E. obtusiloba*. *E. sphaera* also has a wider and not as deep a median furrow on the propodeum. *E. sphaera* has been bred from cynipid galls belonging to the genus *Disholcaspis* on oak only, while *E. obtusiloba* is restricted to the genus *Diplolepis* on rose.

14. *Eurytoma obtusilobae* Ashmead

MAP 6

Eurytoma obtusilobae Ashmead, 1885, p. 13; 1888b, pp. 1–8 [lapsus calami].—Bugbee, 1951, pp. 251–253 [redescription].—Peck, 1951, p. 577.—Burks, 1958, p. 81.

Types: U.S. National Museum, no. 25504; type series consists of 3 females and 1 male of which I have labelled 1 female specimen as lectotype.

Type locality: Jacksonville, Fla.

Distribution: United States: Probably all of North America (Bugbee, 1951).

Hosts: Undetermined cynipid gall on *Quercus obtusiloba* (Ashmead, 1885). *Diplolepis radicum* (Osten Sacken) on *Rosa palustris* and *R. carolina* (Bugbee, 1951).

Remarks: This species is closely related to *E. sphaera*. For distinguishing characteristics, see remarks under the latter species.

Group B. Brevipetiolata

Complex I. Bicolor

15. *Eurytoma semivenae* Bugbee

MAP 7

Eurytoma semivenae Bugbee, 1957, pp. 47–48.—Moser, 1965, pp. 1–95.

Types: 5 females and 8 males; holotype female, allotype male and 3 paratypes in the U.S. National Museum (USNM 66035); paratypes in University of Texas and Cornell University.

Type locality: Palo Duro Canyon, Tex.

Distribution: United States: Texas, Kansas, Ohio, New York, Arkansas.

Host: *Pachypsylla vesicula* (Riley) on *Celtis reticulata, C. occidentalis* and *C. mississippiensis* and *P. mamma* (Riley) on *C. occidentalis.*

Remarks: Additional characteristics that will help to separate this species from the succeeding one are the presence of only two tubercles on the proximal end of the fulcral plate; the shorter ninth tergum that averages .14 mm. (.10–.17) in length, and the yellow color of the horizontal length of the dorsal valves.

16. *Eurytoma flavovultus* Bugbee

MAP 8

Eurytoma flavovultus Bugbee, 1957, pp. 45–47.

Types: 64 females and 25 males; holotype female, allotype male in the U.S. National Museum (USNM 66038); paratypes in the U.S. National Museum, University of Texas, and Cornell University.

Type locality: Austin, Tex.

Distribution: United States: Texas.

Host: *Pachypsylla venusta* Osten Sacken on *Celtis reticulata.*

Remarks: In addition to the characteristics listed in the key, the longer ninth tergum averaging .22 mm. (.20–.25), the black horizontal length of the dorsal valves, and the presence of three tubercles on the proximal end of the fulcral plate, will help to distinguish this species.

17. *Eurytoma bicolor* Walsh

MAP 7

Eurytoma bicolor Walsh, 1870, p. 298.—Ashmead, 1881b, p. 30.—Viereck, 1916, p. 521.—Cole, 1931, p. 35.—Peck, 1951, p. 575.

Types: 1 male and 2 females. Types lost. Neotypes: 29 females and 6 males in the U.S. National Museum.

Type locality: Probably from the vicinity of Rock Island, Ill. where Walsh did much of his collecting. Neotypes: Bloomington, Ind.

Distribution: United States: Connecticut, Washington, D.C., Iowa, Virginia, Indiana, Ohio, Illinois. Canada: Ontario.

Host: Galls on black oak (Walsh, 1870). *Typha latifolia* (cattails) *E. bicolor* larva found in dried galls on stem (Cole, 1931). *Sphex=(Isodontia) harrisi* (Fernald) (Peck, 1951). *Scolytus rugulosus* (Ratzeburg) (Peck, 1951). *Aulacidea tumida* (Bassett). *Aulacidea podagrae* (Bassett). *Eurosta solidaginis* Fitch.

Remarks: Some of the hosts listed for *E. bicolor* seem very doubtful, especially *Sphex harrisi* (Fernald) and *Scolytus rugulosus* (Ratzeburg). The hosts most commonly stated belong to the genus *Aulacidea* that produce galls on several species of *Lactuca.* *E. bicolor* is quite variable,

but the presence of yellow to yellow brown on the lower half of the frons, around the compound eyes, and the anterior lateral edges of the pronotum is quite consistent.

18. *Eurytoma lutea*, new species

MAP 8

Female: Mostly brown to orange yellow. Average length 3.3 mm. (3.0–3.9). Abdomen oval from a lateral view; medium amount of lateral compression; deep brown in color except for yellow venter anteriorly; sculpturing on lateral aspect of sixth tergum limited to lower half; ninth tergum in line with horizontal axis of abdomen and averages .21 mm. (.20–.25) in length. Internal genitalia average 1.6 mm. in length and 1.0 mm. in height, thus the height is more than half the length; dorsal valves black and narrow for horizontal length; turn dorsally, anteriorly, with ventral valves at right angles; stylet arch in an oblique plane. Propodeum with a complete median furrow that occupies most of the wide, shallow concavity; lateral carinae complete to base and central carina in upper half only; lateral areas narrow with fine irregular ridges covering surface. Tegula yellow. Two small spots on dorsum and lateral surfaces of pronotum yellow; rest of thorax brown above and yellow laterally. Head yellow except brown vertex. Antenna with yellow scape and flagellum; clavate; all funicle joints longer than wide; terminal three joints fused together to form a slightly enlarged club. Legs including coxae orange yellow, except brownish infuscation medially on hindfemora and tibiae, and occasionally on midtibiae. Wing veins linear and pale yellow; marginal vein averages .29 mm. (.25–.35) and postmarginal averages .21 mm. (.20–.22) in length.

Male: Averages 2.9 mm. (2.7–3.1) in length. Mostly yellow except for black area on vertex around ocelli; black to dark-brown dorsum of thorax. Abdomen and petiole dark brown. Wing veins yellow. Antenna with yellow scape and brown flagellum; funicle consists of five longer than wide pedicellate segments; the sixth segment not pedicellate distally but separated from terminal unit by a distinct annulation.

Types: 12 females and 7 males. Holotype female, allotype male, and paratypes in U.S. National Museum collection, Washington, D.C. (USNM 66054). Paratypes in the Bugbee collection, Meadville, Pa.

Type locality: Monroe, Mich. L. C. Jones collector.

Distribution: United States: Michigan.

Host: From Elecampane (*Inula helenium* Linneaus).

Remarks: No clear host relationship was discernible from the data on the labels, other than that the species was bred from Elecampane.

It might be phytophagous or parasitic on some gallmaker or borer.

The new species seems most closely related to *E. juniperinus* Marcovitch. The two can be separated, however, by the characteristics contained in the key.

19. *Eurytoma juniperinus* Marcovitch

MAP 8

Eurytoma juniperinus Marcovitch, 1915, p. 166.—Gahan, 1922, p. 41.—Peck, 1951, p. 576.

Types: Paratypes or cotypes in alcohol at Cornell University.

Type locality: Ithaca, N.Y.

Distribution: United States: New York. Canada: Ontario.

Host: Phytophagous in the fleshy part of fruits of *Juniperus virginiana* (Marcovitch, 1915).

Remarks: The broad marginal vein in relation to the linear postmarginal and the weakly clavate antennae are additional characteristics to look for in this species.

Complex II. Pachyneuron

20. *Eurytoma bromi* (Howard)

MAP 9

Isosoma bromi Howard, 1896, p. 11.
Harmolita bromi Gahan, 1922, p. 43.—Peck, 1951, p. 569.
Eurytoma bromi Bugbee, 1956, p. 505.—Burks, 1958, p. 80.

Types: U.S. National Museum, no. 2745, 2 females and 1 male.

Type locality: Los Angeles, Calif.

Distribution: United States: California, New York, Ohio.

Host: *Bromus ciliatus* Linneaus (Howard, 1896). *Muhlenbergia sylvatica.*

Remarks: The weakly clavate antennae with a narrow and elongate first segment of the flagellum and the presence of the reddish-brown hindcoxae and sometimes midcoxae are additional characteristics of this species.

21. *Eurytoma pachyneuron* Girault

FIGURE 6; MAP 10

Eurytoma pachyneuron Girault, 1916, p. 337.—Jones, 1932, p. 412.—Bugbee, 1956, pp. 503–504.
Eurytoma pater Girault, 1920, p. 207.—Phillips, 1917, p. 145.—Gahan, 1922, p. 37.—Brandhorst, 1943, p. 174.
Eurytoma phoebus Girault, 1920, p. 204.—Gahan, 1933, pp. 33–36.—Hill and Pinckney, 1940, pp. 1–13.—Peck, 1951, p. 577.—Bugbee, 1956, pp. 503–504.

Types: U.S. National Museum, no. 20321, 1 female.

Type locality: Glendale, Calif., collected in 1914 by T. D. Urbahns, Webster no. 11214.

Distribution: United States: Northern United States from coast to coast. Canada: Alberta, Quebec.

Host: *Agropyron repens* (Linneaus) (Cornell University collection. Host not stated). *Phytophaga destructor* (Say), (Gahan, 1933). *Harmolita tritici* (Fitch) (Gahan, 1933). *Elymus canadensis* Linneaus (Gahan, 1933, host not stated). *Harmolita atlantica* Phillips and Emory (specimens in U.S. National Museum collection). *Elymus triticoides*, *E. condensatus* (specimens in U.S. National Museum collection). *Harmolita elymophage* Phillips and Emory (Peck, 1951 *in* Muesebeck et al, U.S. Dept. Agric. Monogr., no. 2). *Scolytus rugulosus* Ratzeburg (Peck, 1951 *in* Muesebeck et al, U.S. Dept. Agric. Monogr., no. 2). Galls on *Sitilias grandiflora* (Brandhorst, 1943).

Remarks: See Bugbee (1956) for notes on synonymy of this species. The most likely hosts of *E. pachyneuron* appear to be species of *Harmolita* on *Elymus* species. The record from *Scolytus rugulosus* (Ratzeburg) seems doubtful. The reference to *Phytophaga destructor* (Say), although doubtful, might be possible, since Phillips (1917) showed that *E. pater* = (*E. pachyneuron*) may be parasitic on *Harmolita* larvae in the early stages of its larval development but can finish its late larval growth as a plant feeder. In its earlier stages, it might destroy Hessian fly larvae as well as *Harmolita*.

In the collections of the U.S. National Museum, Department of Agriculture, Ottawa, Canada and Cornell University are numerous long series of *E. pachyneuron*. In the majority of cases, the host plant is cited as a species of *Elymus*, but the insect host was determined in one or two cases only. In the Cornell University collection is a long series from Quackgrass (*Agropyron repens*) but without any insect host designation. *Harmolita* species do occur in this grass and therefore could serve as hosts.

This is a variable species as pointed out in the article by Bugbee (loc. cit.). Leg color which was used to separate *E. pachyneuron*, *E. pater*, and *E. phoebus* proved unreliable, and since the three species were alike in all other characteristics, the latter two were placed in synonymy with *E. pachyneuron*.

The wide postmarginal vein in relation to the linear marginal vein, the clavate antennae, the weakly developed female genitalia with the wide dorsal valves and stylet arch in a horizontal plane, added to the characteristics mentioned in the key, will help to distinguish this species.

22. *Eurytoma eragrostidis* (Howard)

MAP 8

Eurytomocharis eragrostidis Howard, 1896, p. 21.—Girault, 1916, pp. 337–341.—Gahan, 1922, pp. 42, 51.
Eurytoma eragrostidis Peck, 1951, p. 576.

Types: Female holotype no. 2754, U.S. National Museum, Washington, D.C.

Type locality: Lafayette, Ind.

Distribution: United States: Indiana, Illinois.

Host: Reared from *Eragrostis poaeoides* by F. M. Webster in September 1885 and March 1886 (Howard, 1896). *Agrostis alba* (Peck, 1951).

Remarks: This species was shifted to *Eurytoma* from *Eurytomocharis* by Peck (1951). It shows some affinities with *E. pachyneuron* and *E. neomexicana* in possessing a deep, narrow, complete median furrow on the propodeum, and in the lack of lateral compression of the triangular-shaped abdomen as viewed in cross section. Distinguishing features include: reduced umbilicate punctures on the thorax; rounded propodeum without lateral areas; very scanty, if any, sculpturing on the ventrolateral surface of the sixth tergum and the all-yellow legs and coxae.

23. *Eurytoma neomexicana* Girault

MAP 9

Eurytoma neomexicana Girault, 1920, p. 205.—Brandhorst, 1943, pp. 169–170.—Peck, 1951, p. 577.

Types: 3 females and 1 male, no. 20627, U.S. National Museum, Washington, D.C.

Type locality: Koebele, N. Mex.

Distribution: United States: New Mexico, Kansas, Nevada, Colorado. Canada: Saskatchewan, Quebec.

Host: Reared in connection with *Isosoma* (Girault, 1920). *Sideranthus spinulosus* (Brandhorst, 1943).

Remarks: Brandhorst (1943) remarks that "Most every seed of the plant (*S. spinulosus*) has been destroyed by this phytophagous eurytomid."

The reduction in the prominence of the umbilicate punctures on the head and thorax, the deep reddish-brown color, the noticeably clavate antenna, the broad dorsal valves of the female genitalia, and the short first segment of the flagellum that is approximately equal to the pedicle from a dorsal view may be added to the characteristics mentioned in the key.

Complex III. Gigantea

24. *Eurytoma californica* Ashmead

MAP 11

Eurytoma californica Ashmead, 1887, p. 195.—Peck, 1951, p. 575.

Types: U.S. National Museum, no. 25509; type series consists of 4 females and 2 males of which I have labelled and designated 1 female as lectotype.

Type locality: Los Angeles, Calif.

Distribution: United States: California, Washington.

Host: *Callirhytis pomiformis* (Ashmead) (Ashmead, 1887). *Andricus californicus* Ashmead on *Quercus lobata* (specimens in U.S. National Museum collection). *Disholcaspis corallina* (Bassett) on *Q. douglasii* (specimens in U.S. National Museum collection). *D. washingtonensis* (Gillette) on *Q. douglasii* (specimens in U.S. National Museum collection). *D. plumbella* Kinsey, Bugbee collection, Meadville, Pa.

Remarks: *Eurytoma californica* Ashmead is closest to *E. auriceps* and seems to be the west coast equivalent of the latter species. There is a question as to whether it should be considered as a species distinct from *E. auriceps*. If additional material was available from Oregon and Washington as well as east of the Sierras, *E. auriceps* and *E. californica* might grade into each other. The material from Seattle, Washington runs smaller and some of the specimens lack the black splotches on the femora and the tibiae of the legs which are more typical of *E. auriceps*.

The presence of black infuscation on the legs of most specimens, shallow propodeum occupied by the wide median furrow, the heavier, stouter marginal vein, and the heavier, more extensive sculpturing on the sixth abdominal segment can be used to distinguish *E. californica* from *E. auriceps*.

25. *Eurytoma gigantea* Walsh

FIGURE 7; MAP 11

Eurytoma gigantea Walsh, 1870, p. 300.—Ashmead, 1881b, p. 30; 1887, p. 194.—Fyles, 1894, pp. 120–122.—Hughes, 1934, pp. 119–122.—Gahan, 1934, pp. 116–117 (wrongly credits name to Ashmead).—Uhler, 1951, pp. 41, 42.—Peck, 1951, p. 576.—Judd, 1953, pp. 295–296.—Miller, 1959b, pp. 246–251.

Types: 2 females captured at large (Walsh, 1870). The two original specimens have been lost. Neotypes: Neotype female emerged June 10, 1934 from a gall of *Eurosta solidaginis*, collected on Nov. 28, 1933 on *Solidago*, Bugbee collected and determined. Paratype series

of 50 females and males collected in 1933 and 1934 from the same host. Neotype female and paratypes in the U.S. National Museum; paratypes in the Bugbee collection, Allegheny College, Meadville, Pa.

Neotype locality: Bloomington, Ind.

Distribution: United States: Indiana, Florida, New York, Minnesota, Tennessee, Kansas, North Dakota, Arkansas, Mississippi, Michigan, Illinois, Ohio, Montana. Canada: Ontario, Quebec, New Brunswick.

Host: *Eurosta solidaginis* Fitch in Goldenrod.

Remarks: *Eurytoma gigantea* is one of the largest species of the genus found in the United States and is always well represented in most chalcid collections. Its host relationships, an external parasite of the trypetid fly, *Eurosta solidaginis*, have been well documented.

26. *Eurytoma querci-globuli* (Fitch)

MAP 12

Macroglenes querci-globuli Fitch, 1958, p. 812.
Eurytoma querci-globuli Ashmead, 1900, p. 554.—Judd, 1957, pp. 193–195.—Peck, 1951, p. 578.—Bugbee, 1958a, pp. 193–198.
Eurytoma punctiventris Walsh, 1870, p. 299.

Type: U.S. National Museum, no. 1829, holotype female.

Distribution: United States: Connecticut, New York, New Jersey, Minnesota, Wisconsin, Illinois, Michigan, Indiana, Ohio, Pennsylvania, New Hampshire, Kansas, Missouri, Kentucky, Arkansas, Tennessee, North Carolina, Georgia, North Dakota. Canada: Ontario.

Host: *Disholcaspis quercus-globulus* (Fitch). *Disholcaspis mamma* (Walsh). *Disholcaspis colorado* (Gillette). *Disholcaspis cinerosa* (Bassett).

Subspecies: Descriptions, Bugbee, 1958. *Eurytoma querci-globuli rubra* Bugbee. Mississippi, Florida. Host: *Disholcaspis virens* (Ashmead) on *Quercus virginiana*. (Holotype female and male and female paratypes in U.S. National Museum.) *E. querci-globuli utahensis* Bugbee. Utah. Host: *D. colorado* (Gillette) on *Q. utahensis* (holotype female and female paratypes in U.S. National Museum).

Remarks: See Bugbee (1958) for taxonomic, and distributional notes. The color of the abdomen in this species may vary from all black to entirely reddish brown or show varying combinations in between. The yellow scape and legs with occasionally black infuscation on the hindfemora only, will distinguish this species from *Eurytoma gigantea*.

27. *Eurytoma solenozopheriae* Ashmead

MAP 13

Eurytoma solenozopheriae Ashmead, 1887, p. 196.—Driggers, 1927, pp. 253–259.—McAlister and Anderson, 1932, pp. 1164–1169.—Peck, 1951, p. 578.

Neotypes: 18 females and 15 males, collected May 1, 1949, by O. Peck from gall of *Hemadas nubilipennis*. Neotype female and neoparatypes in the collection of the Department of Agriculture, Ottawa, Canada. Neoparatypes in the Bugbee collection, Allegheny College, Meadville, Pa. Ashmead (1887) states that the species was described from specimens from Toronto, Canada, sent to him by William Brodie. The types seem to have been lost.

Neotype locality: Marmora, Ontario, Canada.

Distribution: United States: Maine, Connecticut, Washington, D.C., New Jersey, Massachusetts, New York, Pennsylvania. Canada: Ontario, Quebec.

Host: *Hemades nubilipennis* (Ashmead), gallmaker on blueberry, *Vaccinium corymbosum*, and *V. pennsylvanicum* (Driggers, 1927).

Remarks: Ashmead (1887) implies in his remarks following the description of *E. solenozopheriae* that the host gallmaker on blueberry was the cynipid *Solenozopheria* (=*Loxaulus*) *vaccinii* (Ashmead). Driggers (1927) demonstrated that the true gallmaker was a chalcid, *Hemadas nubilipennis* (Ashmead), and that he was unable to breed a single female specimen of *S. vaccinii* from the galls. It was discovered later that the single female specimen that Ashmead had was bred from a gall on oak rather than *Vaccinium*.

The yellow scape, tegula, and legs including the fore- and midcoxae and the deeper reddish-brown hindcoxa; the reddish-brown abdomen; the very narrow dorsal valves of the female genitalia that bend sharply dorsally, anteriorly, then posteriorly with the ventral valves, forming an arc of 180°, and the vertical plane of the stylet arch, are additional characteristics of this species.

28. *Eurytoma furva* Bugbee

MAP 13

Eurytoma furva Bugbee, 1958a, p. 198.

Types: 11 females and 9 males; holotype female in the U.S. National Museum (USNM 66031); paratypes in the Bugbee collection, Allegheny College, Meadville, Pa., and in the U.S. National Museum.

Type locality: Napa, Calif.

Distribution: Known only from the type locality.

Host: *Disholcaspis washingtonensis* (Gillette) on *Quercus douglasii*.

Remarks: This species differs from *Eurytoma querci-globuli* in the longer sixth abdominal tergum, the reduction of the sculpturing to

the lower half or two-thirds of the lateral surface of the sixth tergum, and in the deeper reddish-brown color of the abdomen and tegulae.

29. *Eurytoma pissodis* Girault

FIGURES 1–5; MAP 14

Eurytoma pissodis Girault, 1917b, p. 88.—Graham, 1918, pp. 175–180; 1926, pp. 26, 29.—Taylor, 1929, vol. 9, no. 4, pp. 167–246; vol. 10, no. 1, pp. 1–86.—Plummer and Pillsbury, 1929, p. 29.—MacAloney, 1930, pp. 1–87.—Peck, 1951, p. 577.

Types: 1 holotype female, no. 20969, 2 paratype females, and 1 male paratype, in the U.S. National Museum, Washington, D.C.

Type locality: Minnesota.

Distribution: United States: Minnesota, Wisconsin, New Hampshire, Massachusetts, New York, Connecticut, California, Washington. Canada: Ontario.

Host: *Pissodes strobi* (Peck) (white pine weevil).

Remarks: Additional characteristics that will help to distinguish this species include the heavy sculpturing on the sixth tergum of the abdomen that covers the dorsal as well as the lateral surface, the yellow legs including the fore- and midcoxae, and the elongate ninth tergum.

30. *Eurytoma cleri* Ashmead

MAP 15

Eurytoma cleri Ashmead, 1894, p. 323.—Hopkins, 1899, pp. 345, 427, 429.—Taylor, 1929, p. 37.—Peck, 1951, p. 576.

Types: 1 female, no. 11206, in the U.S. National Museum, Washington, D.C. is the only type material of this species known, so I have designated it as the type.

Type locality: Morgantown, W. Va.

Distribution: United States: Virginia, North Carolina, New York, New Mexico, California, Montana.

Host: Clerid larvae in scrub pine (Ashmead, 1894). *Pissodes strobi* (Peck) (Hopkins, 1899 and Taylor, 1929). *Ips oregoni* (Eichhoff), *Dendroctonus monticolae* Hopkins.

Remarks: The greatly elongated ninth tergum averaging .42 mm. (.30–.54) and the narrow dorsal valves of the female genitalia in conjunction with the characteristics noted in the key make this species quite distinct.

31. *Eurytoma flavicrus*, new species

FIGURES 19, 29; MAP 15

Female: Head and thorax black; abdomen black changing to reddish brown ventrally; antenna, tegula, legs including coxae yellow; occa-

sionally slight brownish infuscation on hindfemora and some black on forecoxae. Average 2.9 mm. (2.4–3.2) in length. Abdomen longer than head and thorax combined; averaging 1.9 mm. (1.4–2.1) in length; laterally compressed so that greatest width in cross section is in uper third; sixth segment as long as three, four, and five combined; its lateral surface heavily sculptured for lower three-quarters but dorsal surface smooth and shiny; ninth tergum long and pointed; averaging .35 mm. (.25–.40) in length; cercus about middle of length. Internal genitalia averages 2.1 mm. (2.0–2.2) in length and 1.2 mm. (1.1–1.3) in height; ventral and dorsal valves turn dorsally, anteriorly at approximately a right angle; broadened dorsal extension of ventral valves measures .25 mm. at widest part; dorsal valves narrow for horizontal length and yellow in color except for exposed black tip; stylet arch in an oblique plane; length of genitalia averages slightly longer than abdomen because of elongate ninth tergum. Propodeum with a wide concavity marked laterally by lateral carinae that may be complete to base or fade out in lower third; center of concavity finely punctate and with two or three short, incomplete carinae extending toward center from lateral carinae; lateral areas narrow and present in upper half only. Lateral ocelli large and approximately equal in diameter to length of ocellocular line. Antenna with seven segmented flagellum, first five segments longer than wide, truncate, moniliform; sixth separated from terminal unit of two closely fused segments by a distinct annulation. Wing veins light yellow, linear; postmarginal vein short, averaging .12 mm. (.10–.15); marginal vein averaging .35 mm. (.25–.40) or approximately three times the length of the postmarginal.

Male: Length 2.3 mm. Color much as in the female; may be black infuscation on hindfemora and hindcoxae; rest of legs yellow. Antenna with four longer than wide, pedicellate segments; fifth segment without pedicle but separated from six by an annulation; seven and eight closely fused; two whorls of long hairs on two, three, and four. Marginal and postmarginal veins with same relationships as in the female.

Types: 9 females and 7 males. Holotype female and paratypes in the collection of the Department of Agriculture, Ottawa, Canada. Paratypes in the Bugbee collection, Allegheny College, Meadville, Pa. Paratype series dated as follows: 1 female, May 10; 4 females, May 14; 1 female, May 15; 1 female, May 18; 1 female, May 25; 2 males, May 5; 2 males, May 8; 3 males, May 9, 1951.

Type locality: Clemson, S.C., May 14, 1951, W. Mason.

Distribution: Known only from the type locality.

Host: From gall on *Nyssa sylvatica*. Host gallmaker not stated.

Remarks: This species seems most closely related to *Eurytoma contractura*, new species, *E. discordans*, and *E. acuta*. They all have

an elongated abdomen with considerable lateral compression and an elongated ninth tergum. The dorsal valves of the genitalia are narrow for their horizontal length. The yellow legs, tegula, antenna, the very short postmarginal vein in relation to the long marginal, and the four pedicellate segments of the male antenna instead of five, will distinguish this new species from those mentioned above.

32. *Eurytoma contractura*, new species

FIGURES 13, 31; MAP 15

Female: Black except for tarsi and extremities of femora and tibiae. Average 3.0 mm. (2.4–3.4) in length. Abdomen averages 1.7 mm. (1.6–1.8) in length; longer than head and thorax combined and laterally compressed; sixth segment longer than two and three combined, or about a third length of abdomen; densely sculptured on lower half; sparse, silvery pile on segments seven and eight. Ninth tergum long and pointed, averaging .22 mm. (.20–.25) in length. Internal genitalia averages 1.7 mm. (1.6–1.8) in length and 1.1 mm. (1.0–1.2) in height; dorsal and ventral valves turn dorsally, anteriorly at a right angle; stylet arch in an oblique plane; dorsal valves entirely black and narrow for horizontal length but expand, after turning dorsally, into a broader plate; ventral valves expand dorsally into a broad plate averaging .20 mm. at widest part. Propodeum with a wide concavity that is practically all median furrow; lateral areas absent; surface with irregular, horizontal ridges; lateral carinae in upper half to two-thirds. Tegula black. Umbilicate punctures on pro- and mesothorax very shallow and widely spaced with shagreened surfaces between; punctations fade into a shagreened area on anterior third of mesothorax. Antenna with the scape black; flagellum with five longer than wide truncate segments; first segment about twice as long as wide; sixth separated from seventh by a deep annulation and slightly swollen so that antenna appears weakly clavate. Legs with coxae black and black to dark-brown infuscation on all femora and tibiae. Wing veins yellow and linear; marginal vein averages .25 mm. or about 1.3 times the length of the postmarginal that averages .19 mm. (.17–.20).

Male: Color as in the female. Averages 1.8 mm. (1.4–2.1) in length. Antenna with five longer than wide pedicellate segments; last two closely fused. Wing vein relationships as in the female except both veins shorter; marginal averages .21 mm. and postmarginal .16 mm. in length.

Types: 6 females and 6 males. Holotype female and allotype in the collection of the Department of Agriculture, Ottawa, Canada. Paratypes in the Bugbee collection, Allegheny College, Meadville, Pa.

Paratype specimens dated: 5 females, May 4, 1949; 6 males, May 30, 1949.

Type locality: Marmora, Ontario, Canada, May 4, 1949, O. Peck.

Distribution: Known only from the type locality.

Host: *Melanagromyza schineeri* (Giraud).

Remarks: *Eurytoma contractura* is close to *E. flavicrus*, the preceding new species, in the similarly shaped, elongated abdomen, configuration of the female genitalia, and the elongated ninth tergum. The former differs, however, in the black tegula and legs, the shorter postmarginal vein in relation to the marginal, and in the male antenna that has five pedicellate segments instead of only four.

33. *Eurytoma discordans* Bugbee

MAP 16

Eurytoma discordans Bugbee, 1951, pp. 220–223.—Burks, 1958, p. 81.

Types: 9 females and 12 males. Holotype female, allotype and paratypes in the U.S. National Museum (USNM 61219); paratypes in the Bugbee collection, Allegheny College, Meadville, Pa.

Type locality: Howe, Ind., galls, collected on Dec. 20, 1930.

Distribution: United States: Indiana, Massachusetts, Virginia, Michigan, Wisconsin, Maine. Canada: Ontario, Quebec, Alberta.

Host: *Diplolepis globuloides* (Beutenmuller)=(*D. variabilis* (Bassett)) on *Rosa* species, *Periclistus pirata* (Osten-Sacken) and *Synophromorpha*=(*Periclistus*) *sylvestris* (Osten-Sacken).

Remarks: The host of this species is believed to be an inquiline, *Periclistus sylvestris* (Osten-Sacken), that modifies the host gall, *D. globuloides* (Beutenmuller), described by Beutenmuller in 1892 from the gall only. The true gallmaker has been determined as *Diplolepis variabilis* (Bassett), and so *D. globuloides* (Beutenmuller) is placed as a synonym of *D. variabilis* (Bassett) in Hymenoptera of America North of Mexico (1951). *Eurytoma discordans* differs from *E. acuta* in the color of the scape (all yellow or upper extremity black only), the pale yellow color of the wing veins, narrow stigmal club and marginal vein, and the presence of a wide median furrow on the propodeum that maintains same width from top to bottom.

34. *Eurytoma acuta* Bugbee

MAP 16

Eurytoma acuta Bugbee, 1951, pp. 225–228.—Burks, 1958, p. 80.

Types: 27 females and 11 males: Holotype female, allotype and paratypes in the U.S. National Museum, Washington, D.C. Paratypes in the Bugbee collection, Allegheny College, Meadville, Pa.

Type locality: Price, Utah.

Distribution: United States: Utah, Colorado, North Dakota, Michigan, Minnesota, Arizona, Nevada, Montana. Canada: Manitoba, Saskatchewan, Alberta.

Host: *Diplolepis tuberculatrix xerophila* Kinsey and Ayres on *Rosa* species, *Diplolepis arefacta* (Gillette).

Subspecies: The following subspecies are included under *Eurytoma acuta*. The descriptions will be found in Bugbee, 1951, Ann. Ent. Soc. Amer. vol. 44, pp. 213–260.

Eurytoma acuta acuta Bugbee. Utah and Colorado. Hosts: *Diplolepis tuberculatrix* form *xerophila* Kinsey and Ayres, *D. tuberculator* variety *coloradensis* Kinsey and Ayres (USNM 61220).

E. a. absona Bugbee: Colorado. Host: ? *Diplolepis multispinosa* (Gillette) (USNM 61223).

E. a. gemina Bugbee. Arizona. Host unknown (USNM 61224).

E. a. intermedia Bugbee. N. Dakota. Host: Smooth rose gall (USNM 61221).

E. a. ramosa Bugbee. Michigan, Minnesota, Manitoba, Saskatchewan. Hosts: *Diplolepis tuberculator* complex.

Types: U.S. National Museum (USNM 61222).

Remarks: *E. acuta* is a close western relative of the eastern *E. discordans*. It can be distinguished from the latter, however, by the scape that may be all black or upper half black and lower half yellowish brown, the darker brown color of the wing veins, broader marginal vein, almost square stigmal club, the wide median furrow on the propodeum that narrows ventrally, and the black infuscation that usually occurs on all of the legs.

Complex IV. Tylodermatis

35. *Eurytoma prunicola* Walsh

MAP 17

Eurytoma prunicola Walsh, 1870, p. 298.—Peck, 1951, p. 578.
Eurytoma prunicola globulicola Walsh, 1870, p. 299.

Female: Reddish brown to black. Medium-sized species averaging 3.3 mm. (3.0–3.7) in length. Abdomen averages 1.6 mm. (1.5–1.7) in length; oval from a lateral view; laterally compressed but not extremely so; most often reddish brown in color with some black infuscation on dorsal surface of segments three through five and often on posterior half of ninth tergum; less often black may be more extensive but sixth segment usually reddish brown; longer than four and five combined and heavily sculptured on lower lateral surface; dorsal surface smooth; ninth tergum and ventral valves project upward at considerably less than a right angle in relation to horizontal axis of the abdomen; ninth tergum mediumly elongate, sloping and

somewhat blunt, averaging .19 mm. (.15–.25) in length. Internal genitalia with the dorsal valves very narrow for horizontal length and black to light reddish brown in color; dorsal and ventral valves turn dorsally, anteriorly, at approximately a right angle; ventral valves curve dorsally and then slightly posteriorly so that stylet arch and fulcral plate are in a vertical plane; whole structure averages 1.6 mm. (1.2–1.9) in length and 1.0 mm. (.87–1.1) in height; height averages about 64% of the length. Thorax with the tegula yellow or yellowish brown; most often some deep reddish-brown coloration on dorsal and lateral surface of the pronotum; less often dorsal thorax black, or reddish brown extensive on both dorsal and lateral surfaces. Propodeum narrowly concave; shallow concavity occupied almost entirely by the median furrow that may be delimited laterally by distinct, irregular carinae, or lateral carinae may lose identity in lower half; median carina more or less complete to base dividing furrow into small irregular rectangles, largest at top, smallest toward base; median carinae may separate deep rectangular depression below base of median furrow into two foveae; lateral areas narrow and irregularly ridged and pitted. Head most often black, occasionally deep reddish brown frons; fine striae on face converging on the clypeus. Antenna with the scape yellow; flagellum appears six jointed; segments longer than wide. Legs yellow including coxae. Wing veins yellow; marginal mediumly broad and stout and averages .32 mm. (.32–.37) in length; postmarginal linear, short, and averages .15 mm. (.15–.17) in length; thus the marginal is quite often twice the length of the postmarginal; stigmal vein short and club deeply rounded so that it appears almost square.

Male: Black or mostly reddish brown. Averages 2.6 mm. (2.3–3.0) in length. Thorax and abdomen most often black, or reddish-brown tinge to lateral pronotum and occasionally to dorsal pronotum and lower, lateral meso- and metanotum; may be a deep reddish-brown splotch on the lateral aspect of sixth abdominal segment. Head often black, or it may have a reddish-brown frons. Petiole longer than hindcoxa by about 1½ times; most often black but may be reddish brown. Legs and all coxae yellow or hindcoxae may be black to dark reddish brown. Tegula yellow. Antenna with the scape yellow; flagellum appears 7-segmented. Wing veins with same relationships as in the female.

Types: U.S. National Museum, no. 1531, 1 female and 4 males, labelled by A. Bolter, 1890.

Type locality: No locality is given for the types but Walsh described many of his species from material collected in the vicinity of Rock Island, Ill. Lacking any specific evidence otherwise, it seems

safe to assume that the type material of this species may have come from the same area.

Distribution: United States: Kansas, southern Illinois and Indiana to Maryland, south to South Carolina and Mississippi, and west to Texas.

Host: Walsh (1870) lists his specimens as having been bred "from the Cynipidous oak-gall *Q. prunus*, Walsh," which appears to be *Amphibolips prunus* (Walsh) that occurs on various Red Oak species. *A. gainsei* Bassett and *Callirhytis seminator* (Harris).

Remarks: There does not seem to be any basis by which *E. prunicola globulicola* Walsh can be distinguished from *E. prunicola* Walsh. The considerable variation in the reddish-brown coloration of the specimens examined, on which the redescription is based, ranges from abdomens that are all black, except the long sixth segment, to those that are all reddish brown, except for some black infuscation on the dorsal surface of segments three to five. Walsh distinguishes *E. p. globulicola* from *E. prunicola* because of the former's reddish-brown (rufous) abdomen.

E. prunicola appears to be closest to *E. querci-globuli*. The reddish-brown coloration is much the same, and, as in *E. querci-globuli*, the color variation ranges from predominately black in some of the more northern populations (Indiana and Illinois), to predominately reddish brown in the southern material (Bonneau, S.C.). It differs, however, in the oval abdomen with less lateral compression, longer sixth abdominal segment, shorter ninth tergum, less posterior extension of the ventral valves of the female genitalia, less extensive sculpturing on the lateral surface of the sixth abdominal segment, a stouter, broader marginal vein, and a short postmarginal vein in relation to the marginal.

The redescription is based on the types in the U.S. National Museum collection and the considerable number of specimens in the author's collection.

36. *Eurytoma celtigalla* Bugbee

MAP 18

Eurytoma celtigalla Bugbee, 1957, pp. 49–50.

Types: Holotype female, allotype, and paratypes in the U.S. National Museum (USNM 66037). Paratypes in the University of Texas, Austin, Tex., Cornell University, Ithaca, N.Y., and Bugbee collection, Allegheny College, Meadville, Pa.

Type locality: Buda, Tex. Collected June and Aug. 13, 1955, February and Mar. 7, 1956, by J. Riemann.

Distribution: Known only from central Texas.

Host: *Phytophaga celtiphylla* Felt on *Celtis* species, *C. mississippiensis* and *C. laevigata*.

Remarks: This species runs generally smaller in all its measurements than *Eurytoma prunicola*. In addition, the dorsal valves of the female genitalia are broad in contrast to the narrow valves of the preceding species and the postmarginal vein is about 80% the length of the marginal instead of nearer 50%.

37. *Eurytoma lacunae*, new species

MAP 18

Female: Mostly black. Averages 2.2 mm. (2.0–2.3) in length. Abdomen averages 1.1 mm. (1.0–1.2) in length; oval in outline from a lateral and dorsal view; dark brown to black in color; sixth tergum fully two-fifths to one-half the length of the abdomen; its surface both dorsally and laterally covered by fine sculpturing; ninth tergum averages .17 mm. (.15–.20) in length. Internal genitalia average 1.0 mm. in length and .62 mm. in height; thus the height is slightly more than one-half the length; dorsal valves narrow for horizontal length and turn dorsally, anteriorly, at a right angle; stylet arch in an oblique plane; dorsal valves yellowish brown except for exposed distal tip which is black. Propodeum with a wide, shallow depression without any median furrow or distinct lateral areas; surface covered with irregular, fine punctations except for several larger pits dorsolaterally. Tegula yellow. Face with prominent striae from below eye and base of antennae that converge upon the clypeus. Antenna with yellow scape and yellow to light-brown flagellum; funicle five jointed; the first joint longer than wide, the rest becoming shorter, so that number five is about as long as wide; terminal unit of three closely fused segments. Legs including the fore- and midcoxae yellow; hindcoxae may have brown infuscation mixed with the yellow. Wing veins light yellow and linear; marginal vein, which averages .24 mm. (.22–.25), is twice the length of the postmarginal, which averages .12 mm. (.10–.12).

Male: Black. Averages 1.3 mm. in length. Legs all yellow except brownish infuscation on middle of hindfemora. Tegula yellow. Scape and flagellum of antenna yellow to yellowish brown; funicle consists of only four elongate, pedicellate joints; terminal unit of two closely fused joints separated from the fifth by an annulation. Wing veins yellow with the same length relationships as in the female.

Types: Holotype female, allotype, and paratypes in the U.S. National Museum (USNM 66055); paratypes in the Bugbee collection, Meadville, Pa.

Type locality: Kent Island, Md. Specimens collected Feb. 8, 1953, and emerged Mar. 3, 1953.

Host: Bred from galls of *Protaplonx* species on *Baccharis helmifolia*.

Remarks: The male antenna of this new species has only four pedicellate segments in the flagellum. The fifth is separated from the two closely fused terminal units by an annulation rather than a short pedicle. The lack of yellow or reddish brown on the head, thorax, and abdomen will distinguish this species from *Eurytoma juniperinus* or *E. prunicola*.

38. *Eurytoma nigricoxa* Provancher

MAP 18

Eurytoma nigricoxa Provancher, 1887, p. 193.—Peck, 1951, p. 577.

Types: Department of Agriculture, Ottawa, Canada, 1 female with three labels. First label reads: "Type, *E. nigricoxa* Provancher no. 2513." Second label reads: "*E. nigricoxa* Provancher, Type 739." Third label reads: "Lectotype, *E. nigricoxa* Comeau, April, 1940."

Type locality: Ottawa, Canada.

Distribution: Canada: Quebec, British Columbia, and Manitoba.

Host: Rose galls and *Periclistus* species (specimens in Department of Agriculture collection, Ottawa, Canada).

Remarks: This species superficially resembles *E. studiosa* Say, but the thorax is more robust and the propodeum is broad and shallowly concave without a clearly defined median groove. It differs also in the equal length of the marginal and postmarginal veins.

39. *Eurytoma querci* Fullaway

MAP 18

Eurytoma querci Fullaway, 1912, p. 278.—Peck, 1951, p. 578.

Types: Leland Stanford University, lot 508, specimen 45, 1 female; lot 509, specimen 20, 1 male, paratype.

Type locality: Stevens Creek (Santa Clara County), Calif. Collected Nov. 24, 1906. The type female emerged Mar. 6, 1907, and the male emerged in the laboratory Jan. 27, 1907.

Distribution: United States: California.

Host: *Acraspis guadaloupensis* (Fullaway) on *Q. chrysolepis* (Fullaway, 1912) *Andricus lasius* (Ashmead) (Fullaway, 1912).

Remarks: The type female seems close to *E. californica* Ashmead, but it is smaller in all its measurements; has more black infuscation on the legs (not in blotches as in *E. californica*); brown rather than yellow tegulae, and the abdomen is not deeply oval but more rectangular in shape in a lateral view.

40. *Eurytoma auriceps* Walsh

MAP 19

Eurytoma auriceps Walsh, 1870, p. 299.—Triggerson, 1914, pp. 1–34.—Viereck, 1916, p. 522.—Peck, 1951, p. 575.—Bugbee, 1956, p. 503.
Eurytoma auricpes seminatrix Walsh, 1870, p. 299.
Eurytoma vagabunda Ashmead, 1881a, p. 134.

Female: Black. Length averages 3.3 mm. (2.7–4.0). Abdomen black to deep reddish brown; oval in lateral view; averaging 1.3 mm. (1.0–2.0) in length; lateral compression medium; segment six dorsally equal in length to segments four and five combined; sculpturing on lower lateral surface of sixth heavy, but it plays out dorsally so that upper half of lateral surface and dorsal surface are smooth and shiny; white pile covers dorsal and lateral one-half of segment eight; a few scattered hairs on dorsal and lower lateral aspect of seven; ninth tergum short, broad and stubby; averaging .12 mm. (0.7–.22) in length; ninth with exposed ends of ventral valves projecting upward at less than a 45° angle in relation to horizontal axis of the abdomen. Internal genitalia average 1.3 mm. (1.0–2.0) in length; 1.0 mm. (.82–1.5) in height, height averages about 77% of the length; dorsal and ventral valves anteriorly turn dorsally at approximately a right angle; expanded plate of ventral valves may bend slightly posteriorly so that stylet arch approaches a vertical plane; dorsal valves black for horizontal length and narrow; black may or may not continue onto slightly wider dorsal extension of dorsal valves. Tegula yellow. Propodeum shallowly concave; median furrow outlined by distinct lateral carinae, clearly indicated in dorsal third or half only, extent of median carina same or ventrally for about three-quarters of length of furrow; lower area crossed by irregular horizontal ridges dividing surface roughly into rectangles. Scape with outer face all yellow or upper half black to dark brown; antenna filiform; segments of the flagellum in the larger specimens longer than wide with the fifth only a little shorter than the first; in smaller specimens, segments become progressively shorter distally, so that five may be almost square; six closely applied to seven and separated by a shallow annulation; seven appears to consist of two closely fused units, about equal in length to first segment. Lower half of face covered with striae that converge upon the clypeus. Legs chrome yellow or brownish infuscation on hindfemora and tibiae; front coxae may be all yellow, or medial and anterior faces yellow only; midcoxae also variable from yellow to black; hindcoxae black. Wing veins yellow to yellowish brown; marginal vein stout and wider than postmarginal; marginal averages .30 mm. (.22–.42) and the short, stubby postmarginal vein averages .16 mm.

(.12–.22) in length; the postmarginal averages about 53% the length of the marginal; stigmal vein short and stout, averaging .14 mm. (.12–.20).

Male: Body black. Abdominal petiole long, averaging 1.33 times the length of hindcoxa, or hindcoxa about three-fourths length of petiole; legs most often including all coxae, scape and tegula yellow; less often hindcoxa black and some black infuscation on middle of outer face of hindfemora and occasionally hindtibiae. Pile covering face and on thorax, often with a golden-yellow tinge; less often silvery white. Wing veins brown; marginal vein stout, averaging .30 mm. (.20–.37) and postmarginal averages .16 mm. (.12–.20) in length; stigmal averages .17 mm. (.15–.20).

Neotypes: Neotype female and male in U.S. National Museum; paratypes in the Bugbee collection, Meadville, Pa. Additional specimens in the series from which the types were picked include 31 females and 19 males.

Type locality: Elsah, Jersey County, Ill. (Principia College). J. E. Remington collection (ex pupa, June 6, 1946), 155.

Host: Reared from pupa June 5 and 6, 1946, in gall of *Callirhytis seminator* (Harris), L. H. Weld determined, on *Quercus alba*. The lost type material came from *Acraspis erinacei* (Beutenmuller), *A. hirta* (Osten-Sacken), *Amphibolips spongifica* (Osten-Sacken) and *Diplolepis radicum* (Osten-Sacken).

Distribution: *E. auriceps* occurs over most of the eastern half of the United States and Canada probably to the northern limit of white oak distribution. Its hosts are species of cynipids, producing galls, principally on the white oaks *Quercus alba* and *Q. stellata*.

The list of additional host records was taken from specimens in my own collection located at Allegheny College, Meadville, Pa., the collections of the U.S. National Museum, Washington, D.C., and Cornell University, Ithaca, N.Y. *Andricus flocci*, *A. ignotus*, *A. pattoni*, *A. foliatus*, *Amphibolips cookii*, *Acraspis pezomachoides*, *Callirhytis lanata*, *Disholcaspis globulus*, *D. spongiosa*, *D. mamma*, *Holcaspis fasciata*, and *Sphaeroteras melleum*.

Remarks: This is a highly variable species. It has been impossible to find any good morphological characteristics that would distinguish more than one species. All characters seem to intergrade throughout the widespread distributional area.

Since the original types seem to be lost, the redescription is based on a neotype and a paratype series from a locality in Illinois in proximity to the area where Walsh is believed to have collected.

41. *Eurytoma brevivena* Bugbee

MAP 20

Eurytoma brevivena Bugbee, 1958a, p. 198.

Types: 13 females and 1 male; holotype female in the U.S. National Museum (USNM no. 66032); paratypes in Bugbee collection, Meadville, Pa.

Type locality: Grand Canyon, Ariz., collected Jan. 26, 1920, A. C. Kinsey.

Distribution: Known only from the type locality.

Host: *Disholcaspis quercus-globulus* (Fitch) on *Quercus gambelii* (Bugbee, 1958).

Remarks: The host of this species is probably not the species indicated on the labels, because *D. quercus-globulus* does not extend westward to Arizona according to Weld in Muesebeck and others (1951). Its host will probably be found to be a western species of the genus *Disholcaspis* associated with *Quercus gambelii*.

The strong striations on the lower face converging on the clypeus, the short postmarginal vein that averages about half the length of the marginal, and the wide median furrow on the propodeum that narrows ventrally, are additional characteristics of this species.

42. *Eurytoma obtusiventris* Gahan

MAP 20

Eurytoma obtusiventris Gahan, 1934, pp. 116–118.—Hughes, 1934, pp. 119–122.—Breland, 1939, p. 725.—Uhler, 1951, p. 40.—Judd, 1953, p. 296.—Peck, 1951, p. 577.—Miller, 1959b, pp. 246–251.

Types: Holotype female, no. 49893, and 57 paratype females in the U.S. National Museum, Washington, D.C.

Type locality: Ithaca, N.Y., collected and reared by G. F. Hughes in 1930.

Distribution: United States: New York, Michigan, Indiana, Massachusetts, Louisiana, Kansas, Ohio. Canada: Ontario.

Host: *Eurosta solidaginis* Fitch on *Solidago* species (Gahan, 1934).

Remarks: No males have appeared in any of the series of *E. obtusiventris* from the more northern states (New York, Michigan, Indiana) and southern Canada. The females, therefore, must be parthenogenetic. However, the series reared from *Tephritis* (=*Neotephritis*) *finalis* (Loew) on *Helianthus* species from Columbus, Miss., by Breland (1939) and determined by Gahan as *E. obtusiventris*, does contain several males. I have examined some of the Breland specimens and have included them in the succeeding new species.

Characteristics that separate this species from the next one, in

addition to those listed in the key, are given in the section entitled "Remarks," under the succeeding species.

43. *Eurytoma vernonia*, new species

FIGURE 15; MAP 21

Female: Medium-sized species averaging 2.1 mm. (1.8–2.5) in length. Black except for proximal and distal extremities of tibiae and femora, all of tarsi and wing veins which are yellow to yellowish brown. Abdomen dorsally arched anteriorly, triangular in shape from a lateral view and moderately laterally compressed; averaging 1.3 mm. (1.3–1.4) in length; sculpturing on lateral aspect of the long sixth tergum heavy for lower half and then becomes lighter in upper half, disappearing entirely so that dorsal surface is smooth and shiny; ninth tergum short and pointed averaging .12 mm. (.10–.15) in length and in line with the horizontal axis of the abdomen; black to dark brown in color. Internal genitalia short; dorsal and ventral valves turn dorsally, anteriorly, at a right angle to horizontal axis so that stylet arch is in an almost vertical plane; height more than half of length; height averaging .82 mm. (.80–.87) and length 1.2 mm. (1.1–1.3); dorsal valves black and narrow for horizontal length. Propodeum at right angles to the scutellum; wide shallow concavity that is evenly punctate except for three or four large round pits with shiny surfaces along dorsal margin; median furrow, lateral and central carinae may be absent or carinae indicated dorsally by short stubs only. Tegula black. Pronotum narrow; its width less than half its length. Antenna short and stocky; enlarging slightly distally so that they appear clavate; pedicle and first funicle segment about equal in length viewed from above; first funicle segment slightly longer than wide, rest almost square; three closely fused units in the club; scape black. Front coxa with a prominent tubercle about midway on the anterior outer margin. Wing veins yellow; marginal and postmarginal linear, the marginal longer than the postmarginal, averaging .17 mm. (.15–.20) in length and the postmarginal averaging .12 mm.

Male: Black; exceptions as in the description of the female. Length averages 1.6 mm. (1.3–1.9). Antenna with the first four funicle segments about equal in length, pedicellate, longer than wide and depressed medially; a whorl of long hairs arises from each hump on either side of the depression and extends outward at right angles to the longitudinal plane of the segment; fifth funicle segment not pedicellate distally, nor noticeably depressed; its proximal end has longer hairs that appear to arise from a slight eminence and may or may not simu-

late a whorl; distal end with shorter hairs; terminal unit of two, short, closely fused segments separated from the fifth by a deep annulation and about same length as fifth; hair much shorter and extends anteriorly or in same plane as terminal segments. Marginal vein of the forewing averages .16 mm. (.15–.20) and postmarginal vein .11 mm. (.10–.12) in length.

Types: 32 females and 9 males. Holotype female, allotype, and paratypes in the U.S. National Museum (USNM 66056); paratypes in the Bugbee collection, Meadville, Pa.

Type locality: Manhattan, Kans. Collected by R. Schwitzgebel, Sept. 1, 1940. Paratypes collected in August and September 1940.

Distribution: U.S.: Pennsylvania, Oklahoma, and Mississippi.

Host: Bred from trypetid seed maggots in seeds of *Vernonia interior* Small (Ironweed).

Additional host: *Tephritis* (=*Neotephritis*) *finalis* in sunflower (Breland, 1939).

Remarks: This new species is most closely related to *Eurytoma obtusiventris* Gahan. The relationship is suggested by the presence of the raised tubercle on the outer margin of the forecoxae, the narrow pronotum, the short, stocky female antenna, and the sharp angle formed by the scutellum and propodeum. It can be separated from *E. obtusiventris*, however, by its smaller size, the evenly punctate propodeum in contrast to the transversely striated propodeum of *E. obtusiventris*, its more oval and laterally compressed abdomen, and the presence of males with their distinctive antennae.

Schwitzgebel and Wilbur (1943) list two species of parasites as *Eurytoma* new species that were bred from trypetid seed maggots (p. 8). The series of 56 females mentioned above, from which this new species was described, was part of their reared material so that it is very likely that its real host is one of the species of trypetid listed in their paper. The exact relationships of host and parasite were not determined.

44. *Eurytoma bigeloviae* Ashmead

MAP 21

Eurytoma bigeloviae Ashmead, 1890, pp. 25, 45.—Peck, 1951, p. 575.—Bugbee, 1956, p. 504.
Eurytoma chalcidiformis Girault, 1917a, p. 3.

Types: U.S. National Museum no. 11865. Original description based on 1 female specimen, which is designated as type.

Type locality: West Cliff, Colo. (reared by T. D. A. Cockerell).

Distribution: United States: Colorado, California, Utah.

Host: *Trypeta* (=*Tephrella*) *bigeloviae* (Cockerell) (Ashmead, 1890).

Remarks: For notes on the synonymy of *E. chalcidiformis* Girault with this species, see Bugbee (1956, p. 504).

45. *Eurytoma atripes* Gahan

MAP 22

Eurytoma atripes Gahan, 1933, p. 36.—Hill and Pinckney, 1940, p. 8.—Peck, 1951, p. 575.—Nelson, 1953, p. 250.

Types: U.S. National Museum, 1 type female and 1 allotype, no. 44838, plus a paratype series of 24 specimens.

Type locality: Carlisle, Penn.

Distribution: United States: Pennsylvania, Maryland, New York, Ohio, Tennessee, Washington, Oregon, North Dakota. Canada: Alberta.

Host: Hessian fly puparia *Phytophaga destructor* (Say) and 1 specimen from *Cephus cinctus* Norton (Gahan, 1933). Larvae of both *Cephus cinctus* Norton and *Bracon cephi* (Gahan) (Nelson, 1953).

Remarks: Locality records shown on the map were taken from the paper by Gahan (1933) and represent the types plus the 24 additional specimens on which he based the description of the species.

This is a small species with a very short, stubby ninth tergum averaging 0.8 mm. (.06–.10). The female genitalia are weakly developed with wide dorsal valves, only slight dorsal extension anteriorly, and the stylet arch is in a horizontal plane. The antennae are weakly clavate.

46. *Eurytoma levivultus* Bugbee

MAP 21

Eurytoma levivultus Bugbee, 1957, pp. 48–49.

Types: 7 females and 3 males; holotype female in the U.S. National Museum; paratypes in Bugbee collection, Allegheny College, Meadville, Pa.

Type locality: Columbus, Ohio, collected June 1955 by J. Moser.

Distribution: United States: Ohio and Texas.

Host: *Pachypsylla gemma* Riley.

Remarks: The lack of any yellow or reddish-brown color on the frons, the reduced umbilicate punctures on the pronotum, vertex, and occiput of the head, the flat evenly punctate propodeum, and the black infuscation always on the middle and hindfemora and tibiae and often on the front legs help to distinguish this species.

47. *Eurytoma tumoris* Bugbee

Eurytoma tumoris Bugbee, 1962, pp. 345–346.

Types: 24 females and 23 males. Holotype female and allotype male from Santa Cruz, Santa Cruz County, Calif. Collected by R. W. Stark, Mar. 25, 1962. Reared in Berkeley, Calif., Apr. 6, 1962, from Scots pine. Additional specimens in alcohol with the

same locality, collection, and rearing dates as above. Types and paratypes in the U.S. National Museum and paratypes in the Bugbee collection, Allegheny College, Meadville, Pa. and the University of California at Berkeley.

Type locality: Santa Cruz, Santa Cruz County, Calif.

Host: Believed to be phytophagous in the stems of *Pinus sylvestris*.

Distribution: California.

Remarks: See Bugbee (1962).

48. *Eurytoma fossae*, new species

FIGURES 11, 24; MAP 22

Female: Averages 2.8 mm. (2.2–3.3) in length. Black except for the tarsi, knees, and apices of mid- and hindtibiae, occasionally all of foretibiae and wing veins. Abdomen, viewed laterally, narrowly oval; longer than head and thorax combined; averaging in length 1.5 mm. (1.2–1.7); sixth tergum dorsally, longer than three and four combined; sculpturing limited to lower anterior half of lateral surface; rest of surface shiny black; ninth tergum short, averaging .14 mm. (.12–.17) in length. Internal genitalia average 1.5 mm. in length and .77 mm. in height; thus height is about half the length; dorsal valves narrow and black for horizontal length and turn dorsally, anteriorly, with ventral valves at less than a right angle in relation to the horizontal axis; stylet arch in an oblique plane. Propodeum rounded with a deep, narrow concavity occupied by a median furrow, wider at top and delimited laterally by complete lateral carinae to base; central carina may extend from dorsal margin for half to three-quarters length of median furrow; spaces in furrow with shiny, unsculptured surfaces; lateral areas absent or if present very narrow. Thorax with the tegula black. Antenna with the scape black; first segment of the funicle slightly longer than pedicle, itself longer than wide and truncate distally; next four segments subequal to square and truncate distally; distal three segments grouped closely together to form a slightly expanded club. Legs with black infuscation on all femora and tibiae, except occasionally foretibiae; tarsi may have black infuscation on dorsal surface. Wing veins light brown and linear; marginal vein longer than postmarginal, averaging .32 mm. (.25–.35) in length and postmarginal averaging .22 mm. (.20–.22).

Male: Averages 1.9 mm. (1.6–2.2) in length. Wing veins are dark brown; marginal longer than postmarginal, averaging .27 mm. (.25–.30), and postmarginal averaging .16 mm. (.15–.17) in length.

Types: 8 females and 10 males; holotype female and allotype male in the U.S. National Museum collection, Washington, D.C. (USNM 66057). Paratype females in the U.S. National Museum, Bugbee collection, Meadville, Pa., and University of California.

Type locality: Albany, Alameda County, Calif., collected May 1958 by L. E. Caltagirone.

Distribution: United States: California.

Host: Bred from gall on *Salix* species produced by *Euura pacifica* (Marlatt), Burks determined, and *E. resinicola* (Marlatt).

Remarks: The new species resembles *Eurytoma stigmi* Ashmead and *E. tomici* Ashmead in the slightly clavate antennae and the wide median furrow of the propodeum.

49. *Eurytoma tomici* Ashmead

MAP 22

Eurytoma tomici Ashmead, 1894, pp. 325, 326.—Taylor, 1929, p. 37.—Peck, 1951, p. 579.

Types: 1 male type no. 11870, U.S. National Museum. Apparently this is all the type material there is and so the 1 male specimen is designated as type.

Type locality: Morgantown, W. Va.

Distribution: United States: New York, West Virginia.

Hosts: *Tomicus* (=*Pityogenes*) *plagiatus* (LeConte) (Ashmead, 1894), *Cylindrocopturus eatoni* Buchanan (Peck, 1951), *C. furnissi* Buchanan (Peck, 1951), *Epiblema strenuana* (Walker) (Peck, 1951).

Additional hosts: *Phloeosinus* species, and *Cylindrocopturus longulus* (LeConte); records U.S. National Museum.

Remarks: *Eurytoma tomici* Ashmead is very close to *E. stigmi* Ashmead. The temptation to call them one species was strong, but because of the rather meager material of both species, it seems best to keep them separate with the hope that adequate series with precise host data will be available someday.

In general *E. tomici* seems to have more black infuscation on the legs, especially in the male, and less sculpturing on the surface of the sixth tergum. In *E. stigmi* the fine scaling may extend over the dorsal surface while it is limited to the lower one-half of the lateral surface of the sixth tergum in *E. tomici*.

50. *Eurytoma appendigaster* (Swederus)

MAP 23

Pteromalus appendigaster Swederus, 1795, p. 217.

Eurytoma appendigaster (Swederus), Dalman, 1820, pp. 13–14 [designated by Dalman as genotype].—Muesebeck and Dohanian, 1927, pp. 20, 21.—Allen, Holloway and Haeussler, 1940, pp. 1–61.—Peck, 1951, p. 575.—Claridge, 1959, pp. 4–6.

Types: Swederus types nonexistent (see below). Neotype female in the collection of the Naturhistoriska Riksmuseum, Stockholm.

Type locality: Uncertain.

Distribution: Canada: Ontario, New Brunswick.

Host: *Macrocentrus ancylivorous* Rohwer, *Apanteles solitarius* (Ratzeburg), *Cremastus minor* Cushman.

Additional localities: Specimens in the collection of the Department of Agriculture, Ottawa, Canada. Vineland, Ontario, host *Macrocentrus ancylivorus*, *Cremastus minor*. McAdam, N.B., from *Apanteles solitarius*. Moncton, *Apanteles* cacoons. Vineland, Ontario, host *Lasperyresia* (=*Grapholitha*) *molesta* (Busck).

Remarks: The status of *Eurytoma appendigaster* in the United States is uncertain. It is listed by Peck (1951) as occurring in New England, New Jersey, Pennsylvania, and Wisconsin, but I have been unable to verify these localities. I have not recognized the species in my own extensive collection of eurytomids and the only material that I feel sure of in the U.S. National Museum collection is from Europe. The only specimens that seem to fit *E. appendigaster* are in the collection of the Department of Agriculture, Ottawa, Canada.

M. F. Claridge (1959) states that there is no Swederus material of this species existent, but there is material of Boheman, who probably saw the original material. He sent me one of Boheman's specimens and a specimen that Claridge himself had determined as *E. appendigaster*. I have also seen some specimens in the U.S. National Museum collection that A. B. Gahan compared with Boheman's specimens and determined as *E. appendigaster*. There are several characteristics that stand out in the material mentioned above. The male antenna are distinctly seven segmented with segment six separated from seven by a short petiole. All of the males of North American species of Eurytoma that I have seen have segments six and seven either closely fused or separated by a shallow annulation, not by a distinct petiole. The female has the sculpturing reduced on the long sixth abdominal segment, so that it is limited to the lower anterior third of the lateral surface. The umbilicate punctures on the mesonotum are large, close together, and the ridges between them are not sculptured but are smooth and shiny. The first segment of the antenna is longer than wide, at least twice as long as wide. The redescription by Claridge (loc. cit.) does not mention some of the characteristics listed above. He does, however, pick a neotype female from the Boheman collection.

The species is included in this revision because of the specimens in the collection of the Department of Agriculture, Ottawa, Canada.

51. *Eurytoma seminis* Bugbee

MAP 24

Eurytoma seminis Bugbee, 1941, pp. 98–102.—Peck, 1951, p. 578.

Types: 15 females and 8 males; holotype female, male, and female

paratypes in the U.S. National Museum (USNM 58244); paratypes in Bugbee collection, Allegheny College, Meadville, Pa.

Type locality: Hays, Kans.

Host: Phytophagous in the seeds of *Schmaltzia*=(*Rhus*) *trilobata* (Nuttall).

Distribution: United States: Kansas, Oklahoma.

Remarks: The lack of black infuscation on the tibiae of the legs and the reddish-brown to yellow scape of the antenna are additional characteristics to look for in this species.

52. *Eurytoma altifossa*, new species

FIGURES 21, 23; MAP 23

Female: Black except for yellow fore- and midtibiae, extremities of hindtibiae and all femora, scape of antenna, and wing veins. Average in length 3.4 mm. (3.2–3.8). Abdomen globular and plump with only slight lateral compression; sixth tergum about 1½ times the length of the fifth; sculpturing of fine, shallow punctations covers all of lateral surface of sixth tergum and extends over dorsal surface on anterior half; covers most of lateral and dorsal surfaces of all other abdominal terga; ninth tergum short and stubby, averaging .14 mm. (.12–.17) in length. Internal genitalia with broad dorsal valves for horizontal length and their color is black; very little dorsal extension ateriorly, of dorsal and ventral valves, so that stylet arch is close to a horizontal plane; average length of genitalia 1.5 mm. and average height .75 mm.; thus height is about half of length. Propodeum broad with a shallow concavity in center of which is a deep, narrow, complete median furrow that narrows gradually toward base; central carina in upper third; large lateral areas. Antenna filiform; flagellum with five trunctate segments distally; sixth separated from seventh by a distinct annulation, terminal unit of two closely fused segments. Legs may have fore- and midtibiae yellow or with slight, light-brownish infuscation on middle of outer surface; same on hindtibiae; darker brown infuscation toward base of fore- and midfemora and on middle of hindfemora. Wing veins linear; marginal slightly longer than postmarginal; marginal averages .30 mm. (.25–.37) and postmarginal averages .25 mm. (.17–.30); stigmal club rectangular.

Male: Color much the same as in female except that color of the legs is darker and more extensive. Average length 2.4 mm. Relation of wing veins as in the female but average slightly shorter.

Types: 5 females and 1 male. Holotype female, allotype, and paratypes in the collection of the Department of Agriculture, Ottawa, Canada and paratypes in the Bugbee collection, Allegheny College, Meadeville, Pa.

Type locality: Aweme, Manitoba. Collected June 10, 1929, by R. M. White. Paratypes collected June 12, 13, 16, and Aug. 13, 1929.

Host: From galls on *Oxytropis lamberti*. Host relationship not stated.

Distribution: Known only from the type locality.

Remarks: This new species resembles *Eurytoma crassa*, new species, in its plump, globular abdomen and extensive sculpturing of the abdominal terga. It differs, however, in the complete, narrow median furrow on the propodeum, the shorter postmarginal vein in relation to the marginal, and the lack of as dark and extensive infuscation on the legs.

53. *Eurytoma crassa*, new species

FIGURES 16, 25; MAP 24

Female: Black. Length averages 3.4 mm. (3.1–3.8). Abdomen plump; oval from a lateral view; averaging 1.9 mm. (1.7–2.0) in total length; most often whole surface of segments four through eight covered with fine punctations; less often sculpturing reduced on dorsal surface of sixth to a narrow band covering anterior half of surface; ninth tergum broad and pointed, averaging .19 mm. (.15–.22) in length and usually in line with horizontal axis of the abdomen. Internal genitalia with broad and stout dorsal valves for horizontal length anterior to concavity behind exposed tip; dorsal and ventral valves turn dorsally, anteriorly, at slightly less than a right angle; stylet arch in an oblique plane; length of genitalia averages 1.8 mm. (1.7–2.0) and height averages .98 mm. (.92–1.0); anterior dorsal expanded plate of ventral valves, narrow, maintaining same width or narrowing slightly at top. Propodeum broad, shallowly concave, without a median furrow, or an indication of one in dorsal third only; rest of surface covered with irregular ridges with fine punctations between. Tegula black. Antenna with the scape most often entirely black; less often with yellow base; flagellum filiform; segments one to five longer than wide; six closely applied to seven but distinguished from it by a shallow annulation. Legs with black infuscation on all femora and tibiae. Wing veins yellow; marginal and postmarginal linear; marginal averages .26 mm. (.22–.30) in length and postmarginal averages .27 mm. (.27–.32); thus the postmarginal is most often longer than the marginal, less often equal to it in length; stigmal club small and narrowly rectangular in shape.

Male: Black. Averages in length 2.0 mm. (1.5–2.8). Abdomen may be covered with fine, delicate punctations over entire surface, or sculpturing extends over two-thirds of lateral surface of sixth segment

only, leaving dorsal surface smooth and shiny. Propodeum may have a complete wide median furrow that maintains same width from top to bottom. Wing vein relationships and color of the legs same as in the female.

Types: 6 females and 1 male. Holotype female in the U.S. National Museum (USNM 66058); paratypes in Bugbee collection, Allegheny College, Meadville, Pa.

Type locality: Gosport, Ind. Holotype collected on Mar. 28, 1933; emerged May 30, 1933. Paratypes collected on Mar. 28 and Apr. 3, 1933; emerged May 30 and June 1, 1933.

Host: Bred from dipterous gall on Ragweed (*Ambrosia* species). The gallmaker is believed to be a species of *Trypetidae*.

Additional hosts records include *Trypeta* (=*Callachna*) *gibba* Loew, and *T.* (=*Aciurina*) *notata* Coquillett.

Distribution: Eastern half of the United States, from Illinois, Ohio, and Indiana, south to Louisiana and west to Texas and New Mexico.

Remarks: The most likely hosts of this new species seem to be dipterous gallmakers of the family *Trypetidae* and *Ortalidae*.

This species differs from *E. tylodermatis* and *E. pini* in having a broader, shallow, concave propodeum with a wider median furrow that is indicated dorsally only; in other specimens the median furrow may be lacking entirely, and the surface may be covered with fine, even punctations dorsally and irregular horizontal ridges ventrally; postmarginal vein is usually longer or equal in length to the marginal, seldom shorter; the extensive reticulation of the abdominal segments, especially the sixth, which may be completely covered or reduced to a narrow band on the anterior half of the dorsal surface.

54. *Eurytoma terrea* Bugbee

MAP 25

Eurytoma terrea Bugbee, 1951, pp. 238–240.—Burks, 1958, p. 82.

Types: 7 females. Holotype female in the U.S. National Museum. Paratypes in the Bugbee collection, Meadville, Pa.

Type locality: Ashland, Oreg.

Distribution: Oregon.

Host: *Diplolepis polita* (Ashmead) var. on *Rosa* species.

Remarks: Additional characteristics that will help to define this species include: black tegula and scape; black infuscation on femora and tibiae of all legs; broad dorsal valves of the female genitalia that turn dorsally, anteriorly, only slightly with ventral valves, so that stylet arch is in a horizontal plane.

55. *Eurytoma incerta* Fullaway

MAP 16

Eurytoma incerta Fullaway, 1912, pp. 274–282.—Bugbee, 1951, pp. 234–238 [redescription].—Peck, 1951, p. 576.—Burks, 1958, p. 81.

Types: 4 females and 1 male in collection L.S.J.U. (lot 499, specimen 23). Types could not be located under the above number and must be presumed lost. Neotypes: Junction City, Oreg., Apr. 9, 1920, from *Diplolepis neglectus* on *Rosa* species Kinsey collected. In addition, there are 22 females and 20 males in the U.S. National Museum and in the Bugbee collection, Meadville, Pa.

Neotype locality: Junction City, Oreg.

Distribution: United States: Oregon, California. Canada: Saskatchewan.

Host: *Diplolepis neglectus* (Gillette) (=*D. tuberculatrix* (Cockerell)), *D. polita* (Ashmead) variety and *D.t. descansonis* Kinsey and Ayres, on *Rosa* species.

Subspecies: Description in Bugbee, 1951. *Eurytoma incerta varia* Bugbee. California.

Host: *Diplolepis tuberculator descansonis* Kinsey and Ayres.

Remarks: *Diplolepis neglectus* galls are indicated as being modified inquiline inhabited galls of *D. tuberculatrix* (Kinsey and Ayres, 1922). The actual host then is an unknown inquiline cynipid species rather than the true gallmaker.

Eurytoma incerta is the equivalent of *E. acuta* of the east. It runs smaller in all its measurements, the propodeal median furrow is narrower and deeper, and the scape of the antenna is most often all black.

56. *Eurytoma stigmi* Ashmead

MAP 26

Eurytoma stigmi Ashmead, 1895, p. 271.—Peck, 1951, p. 578.

Types: Type series consists of 2 females and 3 males, no. 25507, U.S. National Museum. One female specimen is labelled and designated as lectotype.

Type locality: Los Angeles, Calif.

Distribution: United States: California, Oregon.

Host: *Stigmus inordinatus* Fox (Ashmead, 1895).

Remarks: See *E. tomici.*

57. *Eurytoma sciromatis* Bugbee

Eurytoma sciromatis Bugbee, 1962, pp. 346, 347.

Types: 10 females and 5 males. Holotype female and allotype male in the U.S. National Museum. Paratypes in the Bugbee collection, Allegheny College, Meadville, Pa.

Type locality: Watson, La. Holotype collected Feb. 23, 1962, by S. J. Barras.

Paratypes collected Feb. 23 and Mar. 14, 1960 by S. J. Barras.

Host: Bred from cankers on loblolly pine (*Pinus taeda*) and slash pine (*P. elliotti*) caused by *Cronartium fusiforme*.

Distribution: United States: Louisiana and Georgia.

Remarks: The exact host relationships of this species are not known (see discussion, Bugbee, 1962).

58. *Eurytoma tylodermatis* Ashmead

FIGURE 30; MAP 25

Eurytoma tylodermatis Ashmead, 1896, p. 218.—Gahan, 1932, p. 738 [places *Bruchophagus herrerae* Ashmead as synonym of *E. tylodermatis*].—Pierce, 1907, pp. 39–44; 1908a, pp. 1–53; 1908b, pp. 117–122; 1908d, pp. 380–396.—Chittenden, 1908, pp. 29–32; 1911, pp. 85–93.—Cushman, 1911, pp. 489–510.—Pierce, Cushman, and Hood, 1912, pp. 9–99 [list of weevil hosts].—Dickerson and Weiss, 1920, pp. 32–74.—Myers, 1927, pp. 241–244.—Fenton and Dunham, 1929, pp 66–68.—Parker and Lamerson, 1934, pp. 90–95.—Putman, 1935, pp. 105–109.—Beacher, 1947, pp. 530–544.—Peck, 1951, p. 579.
Bruchophagus herrerae Ashmead, 1902, p. 324.

Female: Black. Length averages 3.9 mm. (3.6–4.8). Abdomen, from the side, narrowly oval or conical; lateral compression slight; averaging 2.2 mm. (1.8–2.6) in length; sixth segment long, averaging .78 mm. (.70–.90) at widest point; sculpturing on lateral surface of sixth tergum heavy ventrally, continues dorsally for about one-half to two-thirds of surface and then fades out so that dorsal surface is smooth and shiny. Valves of ovipositor usually in line with the horizontal axis of abdomen. Ninth tergum short to moderately elongate, broad and somewhat bluntly pointed; averaging .19 mm. (.12–.25) in length. Internal genitalia with very little dorsal extension of valves anteriorly; dorsal valves mediumly broad for horizontal length turning dorsally with ventral valves at much less than a right angle; stylet arch in a horizontal to oblique plane; whole structure averages 1.5 mm. (1.4–1.8) in length and .75 mm. (.62–.87) in height; thus height is half of length or length equal to about twice the height. Tegula black. Propodeum with a wide, shallow concavity and a narrow and deep, to wide and shallow, usually complete median furrow; furrow widest at top and narrows ventrally; lateral areas with rough punctations between fine irregular ridges; median carina in furrow in upper one-third to one-half only; lateral carinae usually discernible to base. Antenna filiform; the scape all yellow or dark brown to black except yellow base; flagellum often with segments one to five longer than wide, moniliform, or segments four and five may be almost square; segment six separated from seven by a distinct annulation but not as truncate as proximal segments; whole structure appears short and

stocky. Legs may have dark brown to black infuscation on all femora and tibiae or may be all yellowish brown; most often some infuscation medially on hindfemora and tibiae; all coxae black or deep reddish brown. Wing veins yellow to yellowish brown; marginal linear to about twice the width of postmarginal; marginal averages .36 mm. (.30–.42) and postmarginal averages .28 mm. (.22–.37) in length; thus marginal is always longer than postmarginal; stigmal club small and more or less rectangular in shape.

Males: Black. Length averages 3.4 mm. (3.0–4.0). Scape of antenna most often black; less often base of scape with varying amounts of yellow or yellowish brown. Legs variable; may be black to dark-brown infuscation on all femora and tibiae; less often infuscation on hindfemora only or legs all yellowish brown. Wing veins brown to brownish yellow; marginal vein averages .33 mm. (.27–.37) and postmarginal averages .24 mm. (.20–.27) in length.

Types: Lectotype female and allotype male, USNM 25503, Agriculture rearing number 113203. One additional female with Agriculture number 113202 in the U.S. National Museum collection, Washington, D.C. The first female cited above is labelled and designated as lectotype. Additional specimens used in connection with the redescription include 89 females and 29 males also in the U.S. National Museum collection.

Type locality: Rosslyn, Va., F. H. Chittenden.

Host: From the larva of *Tyloderma foveolatum* Say.

Distribution: Canada and the eastern two-thirds of the United States, Ontario, south to South Carolina and Louisiana and west to Texas and Arizona.

Remarks: In 1896 Ashmead described *Eurytoma tylodermatis* as a parasite of the "larva of a beetle, *Tyloderma foveolatum* Say." Additional determinations during the succeeding years have raised the number of hosts of *E. tylodermatis* to 56 or more (Peck, 1951, in Muesebeck et al., U.S. Dept. Agric. Monogr., no. 2).

This is due in part to Ashmead's description which is so general that it encompasses many species of the genus *Eurytoma*. Furthermore, his description was based on two females and one male specimen only, which was not enough material to give an adequate picture of the range and limits of variation of the species.

In 1951 the U.S. National Museum loaned me all the specimens which had been accumulating in their collection of Hymenoptera for many years under the label of *E. tylodermatis*. A study was made of the material plus specimens in my own collection amounting altogether to about 4000 individuals. Even this number was not enough to give an adequate picture of the geographical distribution, or the range of variation of the several species in the complex. Many

collections consisted of only one or two specimens. Too often the host was not indicated or only the host plant was named from which the parasite was bred. Exact relationships of host and parasite, therefore, were impossible to determine in many cases.

The results of this study must be considered as only tentative. The need for more material from additional localities, plus more exact determinations of host relationships, will lead to clearer definitions of the species of the complex in the future. Nevertheless the importance of these parasites, occurring as they do on many hosts of economic importance, makes it necessary to make some attempt to put the classification of the parasites on a more realistic basis. The redescription is based on the holotype female, allotype male, and an additional series of 7 females in the U.S. National Museum collection, Washington, D.C.

This species has its closest affinities with the *Eurytoma pini*, *E. diastrophi*, and *E. bolteri* group of species. The whole complex is probably associated with the larvae of weevils and small moths that live in stems of various species of plants. They act as either primary or secondary parasites. Hosts listed for the specimens of *E. tylodermatis* examined include: *Trichobaris texana*, which is reported to occur in stems of *Solanum rostratum; Lixus scrobicollis* in stems of *Ambrosia trifida* (Pierce, 1908 a, b, and c; Pierce, Cushman and Hood, 1912); *Tyloderma foveolatum* in the stems of *Oenothera biennis; Mompha eloisella* also in stems of *O. biennis*. Additional possibilities reported in the literature include *Trichobaris trinotata* in *Solanum carolinense* (Chittenden, 1911) and *Lixus musculus*, in *Polygonum pennsylvanicum* (Pierce, 1907); *Coleophora malivorella* and *Trichobaris rostratum*.

59. *Eurytoma gossypii*, new species

MAP 26

Female: Black. Length averages 4.2 mm. (3.8–4.6). Abdomen plump and oval in lateral view; averages 2.2 mm. (1.9–2.4) in length; long sixth abdominal segment averages .68 mm. (.62–.75); surface of sixth covered by fine shallow pitting which covers all of lateral surface for lower half to three-fourths, then sculpturing recedes toward anterior margin and may continue over dorsal surface in a narrow band. Ninth tergum, mediumly long and pointed; averages .26 mm. in length (.25–.30); anterior half naked and with finely shagreened or smooth surface; posterior half with shallow pits and covered with white pile. Internal genitalia average 2.1 mm. in length; in height 1.2 mm.; anterior expanded plate of dorsal valves averages .20 mm. in width at widest point; dorsal and ventral valves bend dorsally, anteriorly, at about a right angle and stylet arch is in

an oblique plane; dorsal valves broad for posterior two-thirds. Propodeum narrow; deeply concave; median furrow, if present, wide and indicated in upper one-quarter to one-third only; lateral surfaces roughly pitted and center crossed by fine horizontal irregular carinae; flat carina across top center bends ventrolaterally; shallow rectangular depression at base. Tegula black to dark brown. Antenna with the outer face of scape yellowish brown; whole structure short and stocky; segments truncate on distal ends; first segment longer than wide; two to five almost square; last three closely fused to form a bluntly pointed terminal unit. Legs reddish brown on base of forefemora and reddish brown to black medially on hindfemora; apices yellow; tibiae yellowish brown. Wing veins light yellow and thin; marginal and postmarginal veins usually equal in length; marginal averages .29 mm. (.27–.32); postmarginal averages .29 mm. (.25–.35).

Male: Black. Length averages 3.0 mm. (2.6–3.5). Scape usually with lower half yellowish brown and upper half black or dark brown; antenna with first five segments pedicellate; six and seven closely united; first segment longer than wide and covered with long hairs; two to five shorter, though still slightly longer than wide and each with two whorls of long hairs. Legs with dark brown on all femora and tibiae; knees and apices yellowish brown. Wing veins yellow and marginal and postmarginal veins equal in length, marginal averages .26 mm. (.25–.27); postmarginal averages .26 mm. (.25–.30).

Types: 6 females and 5 males. Holotype female and allotype male in the U.S. National Museum (USNM 66059). Paratypes in Bugbee collection, Meadville, Pa.

Type locality: Arlington, Tex. Holotype female collected Aug. 6, 1908, by F. C. Bishop. Male and female paratypes bred Aug. 14–21, 1908.

Distribution: Its range will probably correspond to that of its host *Anthonomus grandis*, the cotton-boll weevil, although this study included specimens from Texas, Oklahoma, and Louisiana only. Fenton and Dunnam (1929) record a species determined as *E. tylodermatis*, which could be this species, from Florence, S.C., and Pierce, Cushman and Hood (1912) list *E. tylodermatis* as a cotton-boll weevil parasite from Arkansas, Louisiana, Oklahoma, Texas, and Mexico.

Host: Parasite of *Anthonomus grandis* Boheman, the cotton-boll weevil.

Remarks: This species seems to be close to *E. pini* in the equal length of the marginal and postmarginal veins, the fine pitting on the surface of segment 6 of the abdomen, which extends as a narrow band over the anterodorsal surface, and the short, stocky antenna with segments 2 to 5 approximately square.

It may be distinguished from *E. pini* by the broad dorsal valves of the female genitalia; the narrower, more deeply depressed propodeum; lack of brown infuscation on the yellowish tibiae; and the shorter but equal lengths of the marginal and postmarginal veins.

The importance of this parasite in reducing the number of the boll weevils is considerable. Fenton and Dunnam (loc. cit.) found it third in importance to *Microbracon mellitor* (Say) and *Catolaccus hunteri* Crawford, at Florence, S.C. Pierce (1910) believes that it occurs most often as a primary, ectoparasite of the larvae of *A. grandis*. He also believed (Pierce 1908a) that this species, which he knew as *E. tylodermatis*, had several alternate hosts including *Lixus scrobicollis* in the stems of *Ambrosia trifida*. In several ways this species is close to *E. tylodermatis* which has been bred from *L. scrobicollis*, but the characteristics listed above will separate them. *L. scrobicollis* is a native weevil while the cotton-boll weevil was introduced from Central America, and it seems to be almost exclusively confined to cotton as its host. Furthermore, the weevil passes through 3 to 5 generations a year thus providing ample stages for the parasite to oviposite on, and a need for alternate hosts seems quite unlikely.

The sex ratio favors the females, as Pierce (1908b) found the percentage of males in his rearings to be 35.4%. Pierce, Cushman, and Hood (1912) report a sex ratio of 64.9% females to 35.1% males.

60. *Eurytoma squamosa*, new species

FIGURE 20; MAP 27

Female: Mostly black. Averages 2.2 mm. (2.0–2.6) in length. Abdomen oval from a lateral view and quite plump; averaging 1.1 mm. (1.0–1.3) in length; terga two through eight heavily sculptured laterally, becoming lighter over dorsal surface; sixth tergum, laterally and dorsally as long or longer than four and five combined; ninth tergum short and stubby, averaging .08 mm. (.07–.10) in length. Internal genitalia short and widely spread; average 1.3 mm. (1.2–1.5) in length and .65 mm. (.57–.75) in height; thus the height is equal to half the length; dorsal valves broad for horizontal length and black; dorsal and ventral valves turn dorsally, anteriorly, only slightly at much less than a right angle; stylet arch in a horizontal plane. Propodeum concavity broad, wide and shallow; median furrow indicated dorsally by barely discernible lateral carinae that converge and fade out entirely about the middle of propodeum; area below median furrow and lateral areas finely and evenly punctate with a few fine horizontal ridges among punctations. Tegula dark brown to black. Scape of antenna black or yellow; pedicle not less than three-quarters the length of the first funicle joint, that is, slightly longer than wide;

rest of funicle joints approximately square. Legs with black to dark-brown infuscation on all femora and tibiae, except yellow foretibiae in a few. Wing veins brownish yellow; marginal vein broad, especially toward distal end; postmarginal vein linear; marginal vein only slightly longer, averaging .19 mm. (.17–.22) in length, than the postmarginal which averages .17 mm. (.17–.20).

Male: Mostly black. Averages 1.8 mm. (1.7–1.9) in length. Abdomen with fine sculpturing over entire surface. Legs with black infuscation on all femora and tibiae. Scape of antenna black; flagellum with five pedicellate segments and a terminal unit of two closely fused segments. Wing veins brown; marginal vein broad, averaging .19 mm. and postmarginal averages .16 mm. in length.

Types: 49 females and 3 males. Holotype female, allotype male, and paratypes in the U.S. National Museum collection (USNM 66060). Paratypes in Bugbee collection, Meadville, Pa.

Type locality: Ventura County, Calif. Holotype female collected Jan. 11, 1941, lot 41–594. Paratypes collected Jan. 11, 1941, lot 41–594, from Pleasanton, Calif.

Distribution: United States: California, Idaho, Washington.

Host: Bred from seeds of *Ceanothus divaricatus*.

Additional host species: *C. thyraiflorus*, *C. cordulatus*, *C. velutinus*, and *C. sanguineus*.

Remarks: This new species is apparently phytophagous within the seeds of several species of *Ceanothus*. It seems to be closely related to the phytophagous seed infesting species (*Eurytoma rhois* Crosby and *E. seminis* Bugbee) in sumac. The sixth abdominal tergum that is longer than four and five combined, and the short stubby ninth tergum, averaging .08 mm. in length will distinguish this species from *E. seminis*, while the plump abdomen with the more extensive sculpturing of the sixth tergum will separate it from *E. rhois*.

61. *Eurytoma calycis* Bugbee

MAP 27

Eurytoma calycis Bugbee, 1961, pp. 33, 34.—Thomas and Herdy, 1961, pp. 34–39.

Types: 27 females and 28 males. Holotype female, allotype male, and paratypes in the collection of the Canada Department of Agriculture, Ottawa, Canada. Paratypes in the Bugbee collection, Allegheny College, Meadville, Pa.

Type locality: Black Sturgeon Lake, Ontario, Canada. Emerged July 2, 1958, J. B. Thomas collection, vial 4, no. 6, lot 59–153. Paratype specimens from the same locality, collected by J. B. Thomas on June 13, 1956, 2 females and 2 males; July 2, 1956, 1 female; emerged June 4–25 and July 2–4, 1958, 24 females and 11 males; June 1958,

15 males. All specimens except those collected in 1956 from vial 4 or 5, nos. 1, 2, 3, 4, 5, 6, 7; lot 59–153.

Distribution: Canada: Ontario.

Host: Phytophagous in the buds of jack pine (*Pinus banksiana*).

Remarks: This species is close to *E. squamosa* in its size relationships, short ninth tergum, sculpturing of the abdomen, color of the legs, and phytophagous habit. It differs, however, in the shallow, complete median furrow and the rougher sculpturing of the lateral areas, the more dorsally produced female genitalia, and the different host.

62. *Eurytoma pini* Bugbee

MAP 27

Eurytoma pini Bugbee, 1958b, pp. 197–200.—Watson and Arthur, 1959, pp. 478–484.—Miller, 1959a, pp. 768, 769.

Types: Holotype female, allotype, and paratypes in the U.S. National Museum (USNM 66025). Paratypes in the Bugbee collection, Meadville, Pa.

Type locality: Washington, D.C., A. D. Hopkins collection.

Host: *Rhyacionia rigidiana* (Fernald), *R. buoliana* (Schiffermüller), and *R. frustrana* (Comstock) on *Pinus sylvestris* and *P. banksiana*. Additional hosts from labels on determined specimens in the U.S. National Museum and Bugbee collections: *Acrobasis rubrifasciella* (Peck). *Eucosoma scudderiana* Clemens. *Pectinophora gossypiella* (Saunders). *Thyridopteryx ephemeraeformis* (Haworth). *Epiblema strenuana* (Walker). *Cremastus cookii* Weed.

Distribution: Throughout the pine-growing regions of Canada and the United States from southern Quebec, Ontario, Manitoba, Saskatchewan, and British Columbia south to Maryland, Virginia, Missouri, and Nebraska.

Remarks: For more complete details of host relationships, see Bugbee (1958). This important parasite has been confused for many years with *Eurytoma tylodermatis* Ashmead. It differs from *E. tylodermatis*, however, in averaging larger (4.5 mm.); presence of more extensive sculpturing on the sixth abdominal tergum; longer ninth tergum (averaging .28 mm.); narrow horizontal portion of the dorsal valves and the lack of a well-defined, complete median furrow on the propodeum.

63. *Eurytoma baccae*, new species

FIGURE 26; MAP 28

Female: Black. Averages in length 3.2 mm. (3.0–3.7). Abdomen oval; lateral compression medium; abdomen averages in length 1.8 mm. (1.6–2.5); sixth segment averages .57 mm. (.50–.62); three-quarters of its lateral surface covered with fine, shallow punctations

which recede dorsally toward anterior margin and continue over dorsal surface in a narrow band; ninth abdominal segment elongate and sharply pointed, averaging .20 mm. (.17–.22) in length. Internal genitalia dorsally extended, anteriorly, so that both dorsal and ventral valves turn dorsad at approximately a right angle in relation to horizontal length; stylet arch in an oblique plane or halfway between a horizontal and vertical plane; dorsal valves not broad, mediumly narrow for horizontal length; whole structure averages 1.6 mm. (1.5–1.7) in length, 1.1 mm. (1.0–1.1) in height. Propodeum concave; faint, wide median furrow sometimes indicated by lateral carinae in dorsal half only or often lacking; lateral areas irregularly punctate and ridged. Tegula black. Scape variable, all black or dark brown except base, or outer face all yellowish brown; flagellum short and stocky; first segment longer than wide; segments two to five becoming progressively shorter so that five is approximately square; six to eight closely grouped, although six is separated from seven by a shallow annulation; flagellum same diameter throughout length, and segments one to five truncate distally. Legs with black to dark brown on all femora and tibiae except sometimes yellowish brown foretibiae; knees and apices yellowish brown. Wing veins yellow and narrow to linear; marginal either longer than postmarginal or equal to it in length; marginal averages .27 mm. (.25–.32) in length and postmarginal averages .24 mm. (.22–.25); stigmal club small and rectangular in shape.

Male: No males in the type series. Two male specimens from Glen Burnie, Md., appear to belong to this series.

Types: 4 females. Holotype female and paratypes in the U.S. National Museum collection (USNM 66061); additional paratypes (3 females and 2 males) in the Bugbee collection, Meadville, Pa.

Type locality: Wathena, Kans., emerged July 3–11, 1939, P.G. Lamerson collection.

Distribution: United States: Kansas, Maryland.

Host: Parasite (external on larvae) of the Strawberry Leafroller (*Ancylis comptana* (Frolich)), and hyperparasite (?) of *Cremastus cookii* Weed, a primary parasite of the Strawberry Leafroller.

Remarks: This species can be distinguished from *E. pini* by its more dorsally produced genitalia that turn dorsad anteriorly, at almost a right angle; its smaller size; shorter marginal and postmarginal veins; and the short, stocky antenna with the segments of the flagellum truncate distally.

The host is a native of Europe; it was introduced into the United States and is now quite widespread. According to Peairs and Davidson (1956, p. 495) it is "present over a large part of the United States, from the Mississippi Valley eastward."

64. *Eurytoma rhois* Crosby

MAP 28

Eurytoma rhois Crosby, 1909, p. 52; 1909, pp. 369, 385–388.—Gahan, 1922, p. 42.—Bridwell, 1923, p. 262.—Bugbee, 1939, pp. 415–427; 1941, p. 101.—Peck, 1951, p. 578.

Types: Female holotype and male allotype, plus paratypes, in the collection of Cornell University, Ithaca, N.Y.

Type locality: Ithaca, N.Y.

Distribution: United States: New York, Washington, D.C., Pennsylvania, Ohio, Indiana, Tennessee, Arkansas, Missouri, Louisiana, Kansas, and Michigan.

Host: Phytophagous in the seeds of sumac, *Rhus typhina*, *R. glabra*, and *R. copallina*.

Remarks: This widespread species occurs wherever its host, sumac species, are found. The oval abdomen with the sixth tergum equal in length to four and five combined, the reduced sculpturing on the lateral surface of the sixth, and its smaller size, will help to differentiate this species from *E. seminis* Bugbee.

65. *Eurytoma levo*, new species

MAP 29

Female: Black. Length averages 3.3 mm. (2.5–3.8). Abdomen averages 2.0 mm. (1.7–2.4) in length; plump with slight lateral compression; laterally and ventrally dark brown to rufous, shiny black dorsally only; oval from a lateral and dorsal view; sculpturing limited to lower half of segment six or less. Ninth tergum short and broad, averaging .15 mm. (.12–.17) in length. Internal genitalia with the dorsal valves mediumly narrow for horizontal length or the length of the exposed portion of the ninth tergum is about two-thirds the width of the dorsal valves at their widest point; dorsal and ventral valves turn dorsally, anteriorly, at less than a right angle; stylet arch oblique; whole structure averages 1.6 mm. (1.5–1.7) in length and 1.0 mm. (.09–1.1) in height; thus height averages 62 percent of the length. Tegula dark brown. Propodeum broad; shallowly depressed; wide median furrow indicated dorsally by lateral carinae for about one-half or less of length; surface of furrow crossed by irregular horizontal ridges; deep pit absent at base of propodeum; lateral areas narrow; dorsal carina flat across top of furrow. Antenna filiform, with the scape yellowish brown and flagellum dark brown; segments of funicle moniliform, longer than wide; legs with dark-brown to black infuscation on all femora; dark brown on middle of mid- and hindtibiae and often on foretibiae; knees and apices yellow and foretibiae may be also; medial and outer faces of forecoxae may be yellowish brown. Wing

veins yellow; marginal broader than postmarginal; marginal averages .26 mm. (.25–.30) and postmarginal averages .26 mm. (.22–.30) in length; thus marginal and postmarginal often equal in length; stigmal club small and rectangular in shape.

Males: There are only two males in the series that are curled up so that a true measurement of their length cannot be made. Probably averages 2.18 mm. in length. Abdomen shiny black to very deep brown. Tegula dark brown. Scape of antenna black except base which may be yellowish brown. Legs with black or dark brown on all femora and tibiae; apices and knees yellowish brown. Wing veins much the same as in the female; marginal averages .25 mm. and postmarginal .23 mm. in length.

Types: 6 females and 2 males. Holotype female, allotype male, and paratypes in the U.S. National Museum (USNM 66062); paratypes in Bugbee collection, Allegheny College, Meadville, Pa.

Type locality: King and Queen Co., Va. Collected June 5 and 8, 1940. L. A. Hetrick collection.

Distribution: United States: Known only from Virginia.

Host: Parasite of pine xyelid gall.

Remarks: The marginal vein is broader than the linear postmarginal and the two veins are most often equal in length. The female genitalia are short in relation to the height and the dorsal valves are narrow for their horizontal length. Scape and tegula are yellowish brown.

66. *Eurytoma crassineura* Ashmead

MAP 29

Eurytoma crassineura Ashmead, 1894, p. 324.—Schedl, 1932, pp. 1, 2.—Peck, 1951, p. 576.

Types: U.S. National Museum no. 25508. Type series consists of 6 females and 3 males of which 1 female has been labeled and designated as lectotype.

Type locality: Morgantown, W. Va. from *Scolytus rugulosus* Ratzeburg.

Distribution: United States: Virginia, West Virginia, Ohio, Washington, D.C., New York, North Carolina, Idaho, Oregon, Colorado. Canada: Quebec, Ontario, Nova Scotia.

Host: Scolytid larvae in plum, cherry, and apple (Ashmead, 1894). *Scolytus rugulosus* Ratzeburg in peach (Ashmead, 1894). *Magdalis armicollis* Say in elm (record from U.S. National Museum collection).

Remarks: The rectangular-shaped abdomen, very broad dorsally, with the long sixth abdominal tergum that often covers the seventh tergum and that lacks sculpturing except at the extreme ventral, anterior edge, help to distinguish this species. In addition, the

slightly longer petiole that has its width about equal to its length, the broad postmarginal vein that is usually twice the length of the marginal, the very weakly developed female genitalia with widespread and broad dorsal valves, and the stylet arch in a horizontal plane make this species quite distinct.

67. *Eurytoma parva* Phillips

MAPS 30, 35

Eurytoma bolteri var. *parva* Phillips, 1918, pp. 11, 14.—Gahan, 1933, pp. 1–147.
Eurytoma bolteri Riley *parva* Girault, 1920, pp. 207, 208.
Eurytoma parva Phillips, 1927, pp. 743–758.
Eurytoma bolteri parva Peck, 1951, p. 575.

Types: Female holotype and 5 female paratypes in the U.S. National Museum, no. 23779.

Type locality: Warrenton, Va. Emerged 1917, W. J. Phillips collection, Webster no. 9350.

Distribution: United States: New York, Virginia, Indiana, Kansas, Ohio, Washington, D.C., Pennsylvania. Canada: Alberta, Saskatchewan.

Host: *Harmolita tritici* (Fitch) on wheat (Phillips, 1918 and 1927). *Lepidopterous* galls on *Solidago* (Girault, 1920).

Additional hosts: *Cephus cinctus* (Department of Agriculture collection, Ottawa, Canada).

Remarks: This species has never had a full description published. Phillips (1918) published a picture but did not give a description because he was using a manuscript name given the species by Girault. Girault's paper (1920) was delayed in publication and does not contain a description either but merely a reference to some specimens from Youngstown, Ohio, Front Royal, Va., Holliday, Utah, and Waterloo, N.Y., with a few notes on scape color, wing vein length, and on variation in the median channel of the propodeum. Thus the species is credited to Phillips. I have been unable to discover all the specimens that Girault mentions, but the three females from Falls Church, Va. (R. A. Cushman collection) from lepidopteran galls on *Solidago* have been determined by me as *Eurytoma bolteri* Riley. The type specimens in the U.S. National Museum, collected by Phillips, are quite different from *E. bolteri*. On the basis stated above, I doubt that *E. parva* has been bred from lepidopterous galls on *Solidago* as stated in Girault's paper.

In the description of *Eurytoma atripes*, Gahan (1933) points out that *E. atripes* and *E. parva* are very similar. He further suggests that the two species may be one and the same. He separates the two on the basis of the smaller size and the shorter funicle joints of *E. atripes*.

Both species are bred from wheat, but *E. atripes* parasitizes Hessian fly puparia (*Phytophaga destructor* (Say)) and *E. parva* destroys larvae of the wheat jointworm (*Harmolita tritici* (Fitch)). There are also records of both species having been bred from the larvae of the wheat stem sawfly (*Cephus cinctus* Norton). *E. atripes*, so far as I have been able to determine, has never been observed emerging from *H. tritici* larvae. Until suitable life-history studies are made that show that these two species of *Eurytoma* are either restricted to distinct hosts or will parasitize the same hosts, it seems best to treat them as two good species.

E. parva displays an additional characteristic that can be used to separate it from *E. atripes*. The propodeum has a wider median furrow with lateral and median carinae that extend ventrally about three-fourths the length of the propodeum before fading out. Below the furrow the surface is finely punctate.

68. *Eurytoma fusca*, new species

MAP 30

Female: Black. Length averages 2.1 mm. (1.8–2.9); abdomen plump; oval from a lateral view and with some lateral compression; length averages 1.4 mm. (1.2–1.6); sixth abdominal segment at longest point averages .47 mm. (.40–.55); fine pitting limited to lower anterior quarter of lateral surface of sixth; surface of rest of segment smooth; ninth abdominal segment short but sharply pointed, averaging in length .15 mm. (.12–.17). Internal geintalia short and weakly developed dorsally, anteriorly; dorsal valves narrow for horizontal length and bend dorsally at less than a right angle anteriorly; stylet arch in an oblique plane but only a little above a horizontal plane; whole structure averages 1.4 mm. in length, .73 mm. in height, and expanded dorsal extension of ventral valves averages .12 mm. in width. Propodeum only slightly depressed to flat; median furrow absent or indicated in upper one-half only; surface finely punctate; slightly arched dorsal carinae curves ventrally for about one-third length of propodeum and then fades out or turns laterally. Scape of antenna most often with outer face black to dark brown, except yellowish-brown base; less often lower half yellowish brown; rest black to dark brown; segments of flagellum slightly longer than wide; first the longest, two to five about equal, six to eight closely fused as a terminal unit. Legs most often with black to dark brown on all femora and tibiae; knees and apices yellowish brown; less often foretibiae all yellowish brown. Tegula often deep reddish brown. Wing veins straw yellow; marginal longer than postmarginal; marginal averages

.24 mm. (.20–.27) and postmarginal averages .18 mm. (.17–.20) in length.

Male: Black. Averages 1.6 mm. (1.1–2.1) in length. Scape with outer face black to dark brown. Black to dark brown on all femora and tibiae of legs, except for knees and apices which are yellowish brown. Wing veins light yellow; marginal averages .23 mm. (.20–.27) and postmarginal averages .18 mm. (.15–.22) in length.

Types: 8 females and 6 males. Holotype female, allotype male, and paratypes in U.S. National Museum (USNM 66063). Paratype specimens in the Bugbee collection, Allegheny College, Meadville, Pa.

Type locality: Crown Point, N.Y., July 19, 1934, O. H. Hammer collection.

Distribution: United States: New York, Kansas, Washington.

Host: Bred from apple curculio material, *Tachypterellus quadrigibbus* (Say), *T. q. magnus* List, and *T. consors* Dietz.

Remarks: This species is close to *Eurytoma mali*, new species, but can be separated from it by its much smaller size, more black to dark-brown infuscation on the legs, and the shallower more uniformly punctate propodeum.

It is probably a primary parasite of the apple curculio. Specimens which were determined as *Eurytoma tylodermatis* have been shown by Parker and Lamerson (1934) and Hammer (1936) to be external parasites of the larvae, pupae, and occasionally adults of *T.q. magnus* List and *T. quadrigibbus* (Say). Although this smaller species is bred from the Apple Curculio along with *E. mali*, and both species occurred in the same series, they can be easily separated by the characteristics mentioned above.

69. *Eurytoma iniquus* Bugbee

MAP 31

Eurytoma iniquus Bugbee, 1951, pp. 253, 254.—Burks, 1958, p. 81.

Types: Holotype female and allotype male in the U.S. National Museum, Washington, D.C. (USNM 61235). Paratypes in the Bugbee collection, Allegheny College, Meadville, Pa.

Type locality: Manitou, Colo.

Distribution: United States: Colorado.

Host: *Diplolepis neglecta* (Gillette) (=*D. tuberculatrix*) on *Rosa* species.

Remarks: The short ninth tergum averaging .15 mm. in length, combined with the broad marginal vein in contrast to the linear postmarginal, and the narrow dorsal valves that turn at right angles dorsally, anteriorly, with the ventral valves so that the stylet arch is vertical, help to characterize this species.

70. *Eurytoma flavicrurensa* Bugbee

MAP 31

Eurytoma flavicrurensa Bugbee, 1951, pp. 258, 259.—Burks, 1958, p. 81.

Types: Holotype female in the U.S. National Museum (USNM 61238). Paratypes in the Bugbee collection, Allegheny College, Meadville, Pa.

Type locality: Ashland, Oreg.

Distribution: United States: Oregon.

Host: *Diplolepis polita* (Ashmead) variety on *Rosa* species.

Remarks: This species differs from other eurytomids from rose galls in the yellow legs including the fore and midcoxae.

71. *Eurytoma longavena* Bugbee

MAP 35

Eurytoma longavena Bugbee, 1951, pp. 249, 250.—Burks, 1958, p. 81.

Types: 4 females and 3 males; holotype female, allotype male, and paratypes in the U.S. National Museum (USNM 61233). Paratypes in the Bugbee collection, Allegheny College, Meadville, Pa.

Type locality: Terrace, B. C., Canada.

Distribution: Canada: British Columbia.

Host: *Diplolepis bicolor* (Harris) subspecies on *Rosa* species.

Remarks: The unusually long marginal vein that averages 1.4 times the length of the postmarginal and the long sixth tergum with the sculpturing reduced to the lower one-third of the lateral surface aid in differentiating this species.

72. *Eurytoma studiosa* Say

MAP 32

Eurytoma studiosa Say, 1836, pp. 272, 273.—Walsh, 1870, p. 299.—Ashmead, 1887, p. 195.—Townsend, 1894, pp. 102–104.—Bridwell, 1899, pp. 203–211.—Triggerson, 1914, pp. 1–34.—Viereck, 1916, pp. 520, 521.—Peck, 1951, p. 578.—Bugbee, 1956, p. 505.

Eurytoma succinipedis Ashmead, 1881, p. 31.

Eurytoma lanulae Fitch, 1859, pp. 781–854. [New synonymy].

Female: Mostly black. Length averages 2.6 mm. (2.3–3.2). Abdomen deep reddish brown to black; oval from a side view and broadly oval from a dorsal view indicating only slight lateral compression. Length of abdomen averages 1.3 mm. (1.3–1.5); long sixth segment equal to four and five combined and lateral surface finely scaled or pitted on lower half to one-third only. Ninth tergum mediumly elongate and pointed, averaging .13 mm. (.10–.17) in length. Internal genitalia with the dorsal valves narrow or mediumly wide for horizontal length; dorsal and ventral valves turn dorsally, anteriorly at less than a right angle, and expanded plate of ventral valves bends only slightly posteriorly; stylet arch and fulcral plate in an oblique rather

than a vertical plane; whole structure averages 1.5 mm. (1.4–1.9) in length and .98 mm. (.87–1.2) in height; thus the height averages about 65% of the length. Thorax black or with a deep reddish-brown tinge. Tegula brown to black. May be a few weak striae on lower part of face. Propodeum shallowly concave with a wide median furrow that may be complete to base; furrow may narrow toward base; central carina divides furrow into squares with largest at top; carina may be complete to base or fade out about halfway down; surface of squares shiny and smooth; large carinated pits dorsolateral to furrow; lateral areas with rough-pitted and ridged surfaces. Scape of antenna yellowish brown to black; flagellum distinctly 6-jointed; joints longer than wide but they become progressively shorter distally so fourth and fifth may be almost square. Legs with black or deep reddish-brown infuscation on all femora and mid- and hindtibiae or fore- and midlegs yellow and hindlegs with infuscation only; coxae black or deep reddish brown. Wing veins yellow, linear; marginal always longer than postmarginal; averaging .29 mm. (.25–.37) in length and postmarginal averages .21 mm. (.17–.27); thus postmarginal is equal to about 72% of length of marginal.

Male: Black. Averages 2.2 mm. (1.8–2.6) in length. Tegula black or deep brown. Scape black or base may be yellow. Antenna with the flagellum seven segmented; first five segments truncate and pedicellate on distal ends and all about equal in length; six and seven closely applied together but separated by a shallow annulation. Legs with black infuscation on all femora and tibiae except forelegs in a few; coxae black. Petiole slightly longer than hindcoxa which averages about 85 to 90% length of petiole.

Neotype: Female, Bloomfield, Ind. Collected Oct. 18, 1936, by A. C. Kinsey; emerged May 5, 1937. In U.S. National Museum. In addition there are 18 female and 15 male specimens in the U.S. National Museum and in the Bugbee collection, Allegheny College, Meadville, Pa.

Host: Neotypes from *Acraspis pezomachoides* (Osten Sacken) on *Quercus alba*, Kinsey determined.

Range: The United States wherever oak occurs.

Additional host records from specimens in the study collections include: *Acraspis hirta, A. erinacei, A. macrocarpae, A. villosa, A. derivatus, A. ozark, A. gemmula, Andricus ignotus, A. cicatricv'a, A. flocci, Callirhytis elongata, C. clavula, C. seminator, Disholcaspis spongiosa, D. washingtonensis, D. quercus-globulus, D. succinipes.*

Remarks: The additional hosts indicated below were taken from the list compiled by Peck (1951, *in* Muesebeck et al., Monogr., no. 2, U.S. Dept. Agric.):

219-931—67——6

Rhabdophaga batatus Walsh, *R. brassicoides* Osten Sacken, *R. cornuta* Walsh, *R. strobiloides* Walsh, dipterous gall on *Leptilon canadense*, galls of *Euura nodus* Walsh, *E. salicis-ovulum* (Dalla Torre), *E. perturbans* (Walsh), *Nematus hospes* (Walsh), *Amphibolips spongifica* (Osten Sacken), *Callirhytis seminator* (Harris), *Diastrophus fragariae* Beutenmuller, *Dryocosmus palustris* (Osten Sacken), *Xanthoteras forticorne* (Walsh), *Mordellistena nigricans* (Melsheimer) in galls of *Eurosta solidaginis* Fitch, *Euura orbitalis* Norton, *E. salicicola* Smith, *Phylloxera caryae-fallax* Riley, *P. c.-globuli* Walsh, *Lasioptera solidaginis* Osten Sacken.

Eurytomid specimens from most of the above hosts were not encountered in the various collections studied so that I can vouch for only those detailed following the redescription of *E. studiosa*.

The majority of hosts belong to the gall-making genera, *Acraspis* and *Andricus* of the family *Cynipidae*.

E. studiosa is an extremely variable, wide ranging species with a wide selection of hosts. It probably contains several subspecies and might be separated into two or more species. The whole complex needs more detailed morphological and life-history studies so that accurate host data can be secured.

The original types of *E. studiosa* are believed lost. In the U.S. National Museum collection are several specimens determined by Ashmead as this species from Jacksonville, Fla. However, they do not seem to fit the original description too well. The original description is rather meager and so generalized that it could be applied to any number of eurytomid species. In one respect, however, Say's description is quite clear—that the color of the legs (i.e., femora and tibiae) is dark, except for the "whitish" tarsi. This is not much to go on, but the specimens determined by Ashmead and other specimens determined later by A. B. Gahan have yellow legs with at the most some light-brown infuscation on the femora and tibiae, as well as yellowish-brown fore- and midcoxae. Say's description also implies that the general coloration of the species is black. Many of the specimens in the collection of the U.S. National Museum have brown abdomens, yellow to brownish scapes and tegulae. In addition, Say's original specimens came from Indiana; and the neotype specimens from Bloomfield, Ind., bred from *Acraspis pezomachoides* on *Quercus alba*, seem to come closer to Say's description than any other material examined.

Ashmead (1887) lists *E. lanulae* Fitch, *E. teredon* Walker, *E. pythes* Walker, and *E. bolteri* Riley as synonyms of *E. studiosa*. *E. bolteri* Riley is a good species. I have been unable to check the two Walker species, so they are not included. *E. lanulae* is represented in the

U.S. National Museum by a single female whose characteristics fall within the range of variation of *E. studiosa* as limited in the revision.

73. *Eurytoma spongiosa* Bugbee

MAP 33

Eurytoma spongiosa Bugbee, 1951, pp. 254–257.—Burks, 1958, p. 82.

Types: 44 females and 16 males; holotype female, allotype male, and paratypes in the U.S. National Muesum (USNM 61236). Paratypes in Bugbee collection, Allegheny College, Meadville, Pa.

Type locality: Bloomington, Ind.

Distribution: United States: east of the Sierra Nevada mountains. Canada: Sasketchewan, Ontario.

Host: *Diplolepis rosae* (Linneaus), *D. dichlocera* (Harris), and *D. tuberculator* (Cockerell) on *Rosa* species.

Subspecies: *Eurytoma spongiosa curvavena* Bugbee. Description, Bugbee (1951). Minnesota. Host: *Diplolepis multispinosa* (Gillette) (USNM 61237).

Remarks: *E. spongiosa* is the eurytomid parasite bred from the common mossy rose gall (*Diplolepis rosae* (Linnaeus)) on wild rose. Its small oval abdomen with only slight lateral compression, short sixth abdominal tergum that is about the same length as the fifth, black tegula, and its weakly developed female genitalia, anteriorly, with the stylet arch in a horizontal plane are distinguishing characteristics in addition to those given in the key.

71. *Eurytoma obtusa*, new species

FIGURE 28; MAP 31

Female: Black. Length averages 3.3 mm. (3.0–4.1). Abdomen plump; slight lateral compression; averages 1.9 mm. (1.8–1.9) in length, first segment, in lateral view, rises abruptly almost straight dorsad from petiole before curving posteriorly. Sixth segment, viewed laterally or dorsally longer than segments four and five together; averages .74 mm. (.70–.80) in length; sculpturing on lateral surface of sixth covers lower half to three-fourths then recedes anteriorly; does not extend over dorsal surface; ninth abdominal segment short and stubby, averaging .13 mm. (.12–.15) in length; fringe of hairs limited to tip and along ventral margin, covering posterior third to quarter of segment; rest naked; cercus close to ventral margin and oval in outline. Internal genitalia averages 1.7 mm. (1.6–1.8) in length, .97 mm. (.95–1.0) in height, and anterior expanded plate of ventral valves averages .18 mm. (.17–.20) in width at widest point; whole structure short but sturdy; dorsal valves wide for horizontal length except just anterior to exposed tips; dorsal and ventral valves turn dorsally, anteriorly at less than a right angle; stylet arch in an

oblique plane. Propodeum depressed and with a narrow, shallow, but distinct median furrow; widest at top; lateral carinae converging immediately below two large rectangular depressions at top of furrow; lateral to rectangular depressions; leading lateroventrally, are three or four pentagonal- or hexagonal-sided pits; below these, rest of lateral areas covered with fine small pits. Tegula black. Scape of antenna all yellowish brown or with upper tip dark brown; segments one to five of flagellum longer than wide and moniliform; segment six closely applied to segment seven but separated by a distinct annulation; six to eight form terminal unit; flagellum filiform. Legs all yellowish brown except black coxae and white tarsi or may be dark brown on base of forefemora and medially on hindfemora; wing veins thin, yellow in color; marginal averages .31 mm. in length (.30–.37) and postmarginal averages .25 mm. (.22–.27); thus the marginal is always longer than the postmarginal.

Male: Black. Averages 2.6 mm. (2.1–3.2) in length; scape of antenna with lower half to two-thirds yellowish brown, rest black; segments one to five pedicellate and slightly constricted; six separated from seven by a distinct annulation; all segments longer than wide; two to five with two whorls of long hairs. Legs light yellowish brown, except hindfemora which are brown or black medially; tarsi white. Marginal vein averages .29 mm. (.27–.32) in length and postmarginal averages .20 mm. (.20–.22).

Types: 7 females and 5 males. Holotype female, allotype male, and paratypes in U.S. National Museum (USNM 66064). Paratypes in Bugbee collection, Meadville, Pa.

Type locality: Haddon Heights, N.J., collected Aug. 8, 1931, by L. J. Bottimer.

Host: Bred from *Bruchus brachialis* Fahraeus in seeds of *Vicia villosa* (Hairy vetch).

Distribution: The host weevil (*B. brachialis*) of this species was introduced from Europe into the United States and first discovered at Haddon Heights, N.J. in June 1930 (Pinckney, 1937). Bridwell and Bottimer (1933) give the distribution of the host as New Jersey, Delaware, Maryland, North Carolina, and Virginia. Peairs (1947) and Peairs and Davidson (1956) add Georgia, and state that it has been "recorded in a limited area near Portland, Oregon, and in Washington." The only parasite specimens that I have seen came from the type locality.

Remarks: This species is close to *E. tylodermatis* in size, length of abdomen, relation of length of marginal and postmarginal veins, genitalic, and antennal characteristics. It differs in possessing a

shorter ninth abdominal segment, a more dorsally arched and plumper abdomen, lighter colored scape of the antenna, and its range.

75. *Eurytoma imminuta* Bugbee

MAP 31

Eurytoma imminuta Bugbee, 1951, pp. 259–260.—Burks, 1958, p. 81.

Types: 9 females and 1 male, holotype female, allotype male, paratypes in the U.S. National Museum (USNM 61239). Paratypes in Bugbee collection, Allegheny College, Meadville, Pa.

Type locality: Pyramid Lake, Nev.

Distribution: United States: Nevada, Utah, Oregon.

Host: *Diplolepis variabilis* (Bassett) variety on *Rosa puberulenta*.

Remarks: Although close to *E. spongiosa*, this species can be separated by its very short dorsal valves (ninth tergum) that average .10 mm. (.07–.12) in length, and the narrow and deep, complete median furrow on the propodeum.

76. *Eurytoma bolteri* Riley

MAP 34

Eurytoma bolteri Riley, 1869, p. 177.—Viereck, 1916, p. 521 [emendation].—Ashmead, 1887, p. 195.—Bridwell, 1899, pp. 203–211.—Leiby, 1922, pp. 81–94.—Barber, 1938, pp. 173–176.—Peck, 1951, p. 575.

Types: 3 females, no. 2789 in the U.S. National Museum.

Type locality: One of the female types bears the no. 38E. The following notations under type locality were taken from a card file in the U.S. National Museum. Washington, D.C., galls collected Aug. 1867; emerged May 1, 1868.

Distribution: United States: Washington, D.C., New York, Virginia, Indiana, South Dakota, Kansas.

Host: *Gnorimoschema gallaesolidaginis* (Riley) on *Solidago* species.

Remarks: The commonest host for this species is *Gnorimoschema gallaesolidaginis* on *Solidago* species. Other host designations are questionable as I have bred many specimens of eurytomids and never recovered this species from any other host.

E. bolteri is a large species averaging 5.0 mm. in length. The marginal and postmarginal veins are most often equal in length, and the propodeum is wide with a shallow concavity, in the center of which is a narrow, shallow median furrow that narrows ventrally. The lateral surface of the sixth tergum is heavily sculptured to the dorsal surface where sculpturing becomes lighter and may continue over dorsal surface along anterior border, or fade out altogether.

77. *Eurytoma spina* Bugbee

MAP 34

Eurytoma spina Bugbee, 1951, pp. 250, 251.—Burks, 1958, p. 81.

Types: 5 females; holotype female, paratypes in U.S. National Museum collection, no. 61234.

Type locality: La Grande, Oreg.

Distribution: United States: Oregon. Canada: Saskatchewan.

Host: *Diplolepis tuberculator* var. *versicolor* Kinsey and Ayres on *Rosa* species.

Remarks: Characteristics in addition to those in the key include the length of the ninth tergum that averages .22 mm., the length of the marginal and postmarginal veins (the marginal averages only .04–.05 mm. longer than the postmarginal), and the weakly developed female genitalia with wide dorsal valves for horizontal length.

78. *Eurytoma picea*, new species

MAP 35

Female: Black except for brown wing veins, yellow base of scape, and extremities of femora, tibiae, and whitish tarsi. Length averages 3.6 mm. (3.1–4.1). Abdomen oval from lateral and dorsal views; medium lateral compression so that greatest width in cross section is nearer middle; sixth tergum about two times the length of the fifth; smooth and shiny surface except for fine scaling on lower, anterior half; ninth tergum elongate, averaging .22 mm. (.24–.25) in length. Internal genitalia with narrow dorsal valves that turn dorsally, anteriorly, with the ventral valves at slightly less than a right angle so that stylet arch and fulcral plate are in an oblique plane; dorsal valves dark brown to black for entire length; whole structure averages 1.7 mm. (1.6–1.8) in length and .97 mm. (.95–1.0) in height. Propodeum narrowly concave with a wide, shallow, complete median furrow that narrows toward base; central carina about one-quarter to three-quarters length of furrow; surface between horizontal ridges within furrow, smooth and shiny; lateral areas narrow or nonexistent. Antenna with a flagellum of five truncate, slightly moniliform, segments; sixth separated from the terminal unit by a shallow annulation. Legs with black to dark-brown infuscation on all femora and tibiae. Wing veins brown; marginal about two times the width of postmarginal, quite long, averaging .40 mm. (.35–.50) in length; postmarginal averages .27 mm. (.22–.32) in length.

Male: Color as in the female except that scape is entirely black. Length averages 2.2 mm. (2.1–2.4). Abdomen sculptureless dorsally and laterally. Umbilicate punctures on mesothorax with interstices sculptureless. Antenna with five pedicellate segments and a terminal unit of two closely fused segments in flagellum; segments two to five with two whorles of long hairs. Marginal vein averages .36 mm. (.32–.40) and postmarginal averages .25 mm. (.22–.27) in length.

Types: Holotype female, allotype, and a paratype series of 24 females and 19 males in the collection of the Department of Agriculture, Ottawa, Canada. Collected or emerged July 29, 1938, Sept. 6, 1938, and May 5–19, 1939. R. H. Longmore collector. Paratypes in the Bugbee collection, Allegheny College, Meadville, Pa. and the U.S. National Museum.

Type locality: New Westminster, B. C., Canada, forestry station. Distribution: United States: Washington. Canada: British Columbia.

Host: *Pissodes sitchensis* Hopkins on *Picea sitchensis*.

Remarks: This new species runs smaller than *Eurytoma pissodis;* has more infuscation on the legs; brown wing veins; less sculpturing on the sixth abdominal tergum and a distinct, complete median furrow on the propodeum. Its host is a different species of weevil occurring on the Sitka Spruce (*Picea sitchensis*).

79. *Eurytoma calcarea* Bugbee

MAP 36

Eurytoma calcarea Bugbee, 1951, pp. 240–248.—Burks, 1958, p. 81.

Types: Holotype female, allotype, and paratype in the U. S. National Museum (USNM 61227). Paratypes in the Bugbee collection, Allegheny College, Meadville, Pa.

Type locality: Wellsville, Utah.

Distribution: Eastern two-thirds of the United States from the Atlantic coast west to Oregon and south to Kansas.

Host: *Diplolepis variabilis* (Bassett) and *D. bicolor* (Harris) on *Rosa* species.

Subspecies: Description, Bugbee (1951).

Eurytoma calcarea ignobilis Bugbee (USNM 61228). Nebraska. Host: *Diplolepis bicolor* (Harris).

E. c. infima Bugbee. Illinois. Host: *D. bicolor* (Harris) (USNM 61230).

E. c. lucida Bugbee. Illinois. Host: *D. bicolor* (Harris) (USNM 61229).

E. c. mimica Bugbee. Maine and Massachusetts. Host: *D. bicolor* (Harris). (USNM 61231.)

E. c. singularis Bugbee. Massachusetts. Host: *D. nebulosus* (Bassett). (USNM 61232.)

Remarks: The dorsal and ventral valves of the female genitalia turn dorsally, anteriorly, at right angles so that the stylet arch is in an oblique plane and the dorsal valves are uniformly narrow for their horizontal length (see figs. 9 and 10, Bugbee, 1951).

80. *Eurytoma apiculae* Bugbee

Eurytoma apiculae Bugbee, 1966, pp. 210–211.

Types: 21 females and 17 males. Holotype and allotype from a series of 8 females and 10 males from Contra Costa County, Calif. Collected July 8, 1965, from nest of *Ceratina punctigena*, nos. 261 and 142 c, d, e, h, by T. Brown and H. Daly. Types and paratypes in the U.S. National Museum, Univ. of California, Berkeley, and Bugbee collection, Allegheny College, Meadville, Pa.

Type locality: Contra Costa County, Calif., Russel Tree Farm.

Host: *Ceratina punctigena* Cockerell, *C. nanula* Cockerell, and *C. dallatorreana* Friese.

Remarks: See Bugbee, 1966.

81. *Eurytoma mali*, new species

FIGURES 18, 27; MAP 36

Female: Black. Averages 4.1 mm. (3.4–4.8) in length. Abdomen plump with only slight lateral compression, averaging 2.4 mm. in length (2.1–2.6); sixth abdominal segment long, averaging .74 mm. (.65–.80); sculpturing on lateral face of sixth limited to lower half; ninth segment elongated and sharply pointed, averaging .25 mm. in length (.20–.30); internal genitalia averages 1.9 mm. (1.5–2.1) in length and in height 1.1 mm. (1.0–1.2); expanded anterior plate of ventral valves averages .19 mm. (.15–.22) at widest point; dorsal valves narrow for horizontal length and turn dorsally with ventral valves, anteriorly, at a right angle in relation to horizontal length; stylet arch oblique or halfway between a vertical and horizontal plane. Propodeum concave; indications dorsally of a wide, shallow median furrow that may fade out completely in lower quarter; lateral areas with uneven surface finely punctate and irregularly ridged, and without deeper five- or six-sided punctures limiting areas dorsally. Tegula deep brown to black. Antenna with the outer face of scape all yellowish brown; segments one to five of a flagellum

longer than wide and truncate distally; six separated from seven by a shallow annulation; flagellum filiform. Legs may have all femora and tibiae yellowish brown or hindfemora may be brown to dark brown medially. Wings with the veins yellow to brown; marginal vein thin and long, averaging .38 mm. (.35–.40) in length; postmarginal shorter than marginal, averaging .30 mm. (.27–.32) in length; stigmal club narrowly rectangular in shape.

Male: Black. Averages 3.3 mm. (3.0–3.6) in length. Outer face of scape black except yellowish-brown basal extremity. Legs with femora and tibiae of fore- and midlegs yellowish brown; hindfemora dark to light brown, except yellowish-brown apices and knees; hindtibiae yellowish brown. Wing veins brownish yellow to straw yellow; marginal vein longer than postmarginal; marginal averages .37 mm. (.35–.40) in length; postmarginal averages .27 mm. (.25–.27).

Types: 6 females and 4 males. Holotype female, allotype male, and paratypes in the U.S. National Museum (USNM 66065). Paratypes in the Bugbee collection, Meadville, Pa.

Type locality: Troy, Kans. Collected or bred (?) July 2–14, 1932. P. G. Lamerson collection.

Distribution: Kansas, New York, Wisconsin, Washington.

Hosts: Parasite of the apple curculio, *Tachypterellus quadrigibbus* (Say), *T. q. magnus* List, and *T. consors* Dietz.

Remarks: This species is apparently widespread, occurring wherever apples are grown and its hosts, the apple curculio, *Tachypterellus quadrigibbus* or *T. consors*, are present. The importance of the parasite as a natural control of the host is great. Parker and Lamerson (1934) credit it with over half of the total parasitism of the curculio (*T.q. magnus*) in northeast Kansas in the years 1932–1933. Ritcher (1936), using the name *E. tylodermatis*, states that it was the most important and numerous parasite in Wisconsin in 1934–1935, where parasitism ran as high as 40–63%. Hammer (1936) lists it again as *E. tylodermatis*, from *T. quadrigibbus* in the Champlain Valley.

Distinguishing features of this species are the extremely narrow dorsal valves of the female genitalia, the reduced sculpturing on the sixth abdominal segment, the all yellowish-brown legs with the exception of the reddish-brown tinge to the hindfemora, and the longer than wide segments of the antenna. It resembles *E. fusca*, new species, but the characteristics mentioned above will separate them.

82. *Eurytoma diastrophi* Walsh

MAP 37

Eurytoma diastrophi Walsh, 1870, p. 299.—Mayr, 1878, p. 311.—Ashmead, 1881, p. 30; 1887, pp. 194–198 [Ashmead proposed the name, *E. Mayri* for *E. diastrophi* of Mayr 1878].—Bridwell, 1899, pp. 203–211.—Viereck, 1916, p. 521.—Peck, 1951, p. 576.

Types: Walsh (1870) states that there were 2 males and 19 females on which his description was based. In the U.S. National Museum is a single male, bearing the type no. 1532 and the notation, "through A. Bolter, 1890." This male speciman is probably not one of the original types. In order to have something more definite to go by, I have chosen a neotype female from Bloomington, Ind. The female emerged May 23, 1933, from a gall of *Diastrophus nebulosus* collected by R. Bugbee on Apr. 12, 1933, on *Rubus* species, Kinsey determined. An additional neoparatype series from the same locality, date of collection, and host includes 49 males and 28 females that emerged from May 23–30, 1933. Neotype female and neoparatypes in the Bugbee collection, Allegheny College, Meadville, Pa. and in the U.S. National Museum, Washington, D.C.

Type locality: Probably from the vicinity of Rock Island, Ill. where Walsh conducted much of his collecting. Neotype locality, Bloomington, Ind.

Distribution: United States: Connecticut, New Jersey, New York, Virginia, Massachusetts, Washington, D.C., North Carolina, Indiana, Illinois, Tennessee, Kansas, Colorado, New Mexico, or wherever blackberry occurs.

Hosts: *Distrophus cuscutoeformis* (Osten Sacken). *Diastrophus nebulosus* (Osten Sacken). *Diastrophus niger* Bassett. Galls of *Callachna gibba* (Loew) (Peck, 1951).

Remarks: The host record *Callachna gibba* (Loew), is very doubtful as this species seems to be restricted to gallmakers on blackberry belonging to the cynipid genus *Diastrophus*.

This is a medium-sized species averaging 3.9 mm. in length. The propodeum displays an incomplete, weakly developed median furrow in the upper half to one-quarter, or furrow may be absent entirely. Ninth tergum averages .26 mm. (.17–.32) in length. Female genitalia moderately developed anteriorly, so that stylet arch is in an oblique plane.

Appendix

Species Not Included in the Revision

The species listed below have not been included in the revision for one or more of the following reasons: Types not checked by the author; types inadequate to make a satisfactory judgment; types lost; the original description too brief or general to allow a definite decision; inclusion in the genus *Eurytoma*, as limited by the generic description, doubtful.

The types of the six species *Eurytoma abatos*, *E. cretheis*, *E. hecale*, *E. pythes*, and *E. teredon*, described by Walker (1843) and *E. iphis* Walker (1846), are located in the British Museum and I have not been able to check them personally. Letters from M. F. Claridge, Department of Zoology, University College, Cardiff, England, and G. J. Kerrich of the British Museum, London, give their impressions of the Walker types. They seem to agree that *E. iphis*, *E. cretheis*, and *E. pythes* are probably not true *Eurytoma*. The British Museum did loan me a single cotype male of *E. teredon*, and it is a good *Eurytoma*, but the single male specimen is insufficient to determine the status of the species.

E. abnormicornis Walsh (1870). This species was described from a single female captured at large that seems to be lost. The three males in the U.S. National Museum collection under this species are not adequate to determine the position of the species.

E. albipes (Ashmead). Transferred to the genus *Tenuipetiolus* (Bugbee, 1951).

E. albitarsis Ashmead, nomen nudum (Bugbee, 1956).

E. ashmeadi (Ashmead). Ashmead (1894, page 327) described *Eurytomocharis minuta* and designated it as the genotype. *Minuta* was preoccupied by Walker (1832), and so the new name was proposed by Peck (1951, page 575) who, at the same time, placed *Eurytomocharis* as a synonym of *Eurytoma*. Until the genera of the family *Eurytomidae* are revised, I would exclude *ashmeadi* from the genus *Eurytoma*.

E. aulacis Ashmead, nomen nudum (Bugbee, 1956).

E. brachypterum (Ashmead). This species was orginally described as *Systole brachyptera* by Ashmead in 1886 (page 126). In 1894 (page 328) he transferred the species to *Evoxysoma* and in 1951 (page 574) Peck placed the genus as a synonym of *Eurytoma*. The very elongate abdomen is not typical of the genus *Eurytoma*, so the species is not included in the revision.

E. floridana (Ashmead) 1887, was described as *Lamprostylus floridanus* from a single male captured at large and transferred to the genus *Eurytoma* by Peck (1951). The shape and sculpturing of the abdomen are not typical of *Eurytoma*.

E. hegeli, nomen nudum (Bugbee, 1956).

E. lanulae Fitch, 1859. This species is a synonym of *Eurytoma studiosa* Say, 1836, according to Ashmead, 1887. The single female type, no. 1824, in the U.S. National Museum collection would fall within the range of variation of *E. studiosa*.

E. maga Girault, 1920. Removed to the genus *Prodecatoma* (Bugbee, 1956).

E. medicaginis (Gahan). Transferred to the genus *Tenuipetiolus* (Bugbee, 1951).

E. muhlenbergiae (Howard), 1896. Removed to the genus *Eurytomocharis* (Bugbee, 1956).

E. nevadense Ashmead, 1894. This species is represented by a single male specimen located in the collection of the Philadelphia Academy of Science.

E. orbiculata Say, 1836. Described from a single male specimen that seems to be lost. The description is not complete enough to place this species with certainty.

E. polygraphi (Ashmead). Transferred to the genus *Ipideurytoma* (Bugbee, 1956).

E. querci-pisi (Fitch), 1859. Described originally in the genus *Macroglenes*, the species was removed to *Eurytoma* by Ashmead in Smith's, "Insects of New Jersey," 1900. The holotype female, no. 1830, in the U.S. National Museum collection has the abdomen broken off and glued on a tip below the rest of the specimen. It is possible that this is not the original type as it does not fit the original description. The specimen is yellow to reddish brown and Fitch describes the species as black.

E. sculpta Ashmead, 1887. Transferred to *Bruchophagus* (Bugbee, 1956).

E. triodiae (Howard), 1896. Holotype female no. 2755 in the U.S. National Museum. Howard placed this species in the genus *Eurytomocharis* but Peck in Muesebeck, Krombein and others (1951) placed it in *Eurytoma*. Until the genera of the family *Eurytomidae* are studied and more clearly delimited, I prefer to exclude this species from *Eurytoma*, chiefly on the basis of the lack of any sculpturing on the lateral surface of the sixth tergum.

E. vitis (Saunders), 1869. Although transferred to the genus *Eurytoma* by Peck (1951), this species belongs in the genus *Evoxysoma*, which seems to be a recognizable genus (see Bugbee, 1936, pages 199, 200).

Fossil Species

Eurytoma sepulta Brues, 1910. Described from three specimens, no. A9 (type), A103 both from Station 14 and no. 2100, MCZ, Florissant, Colo. Types in the American Museum of Natural History.

Eurytoma sequax Brues, 1910. No. A120 from Station 14, Florissant, Colo. Type in the American Museum of Natural History.

Parasites and Hosts

Eurytoma acuta Bugbee	*Diplolepis tuberculator* var. *xerophila* Kinsey and Ayres.
	D. arefacta (Gillette) on *Rosa* species.
E. altifossa Bugbee	From galls on *Oxytropis lamberti;* host relationship not stated.
E. apiculae Bugbee	*Ceratina punctigena* Cockerell
	C. nanula Cockerell
	C. dallatorreana Friese
E. appendigaster (Swederus)	*Macrocentrus ancylivora* Rohwer
	Apanteles solitarius (Ratzeburg)
	Cremastus minor Cushman
E. atripes Gahan	*Phytophaga destructor* (Say)
	Cephus cinctus Norton
	Bracon cephi (Gahan)
E. auriceps Walsh	*Amphibolips spongifica* (Osten Sacken)
	A. cookii Gillette
	Andricus pattoni (Bassett)
	A. foliatus Ashmead
	A. ignotus (Bassett)
	A. flocci (Osten Sacken)
	Acraspis pezomachoides (Osten Sacken)
	A. erinacei (Beutenmuller)
	Callirhytis lanata (Gillette)
	C. seminator (Harris)
	Diplolepis radicum (Osten Sacken)
	D. weldi (Beutenmuller)
	Disholcaspis mamma (Cresson)
	D. spongiosa (Karsch)
	D. quercus-globulus (Fitch)
	Dryocosmus imbricariae (Ashmead)
	Philonix fulvicollis Fitch
	Sphaeroteras melleum (Ashmead)
E. baccae Bugbee	*Ancylis comptana* (Frolich)
E. bicolor Walsh	*Aulacidea tumida* (Bassett)
	A. podagrae (Bassett)
	Isodontia harrisi (Fernald)
	Scolytus rugulosus Ratzeburg
	Eurosta solidaginis Fitch
	In dried galls on stem of *Typha latifolia*· host relationship not stated.
E. bigeloviae Ashmead	*Trypeta bigeloviae* (Cockerell)

E. bolteri Riley	*Gnorimoschema gallaesolidaginis* (Riley)
	Eurosta solidaginis Fitch
	Tyloderma foveolatum Say
E. brevivena Bugbee	*Disholcaspis quercus-globulus* (Fitch)
E. bromi (Howard)	Phytophagous in stems of *Bromus ciliatus*, *Muhlenbergia sylvatica*, and timothy.
E. calcarea Bugbee	*Diplolepis bilolor* (Harris)
	D. variabilis (Bassett)
E. californica Ashmead	*Callirhytis pomiformis* (Ashmead)
	Andricus californicus Ashmead
	Disholcaspis corallina (Bassett)
	D. plumbella Kinsey
	D. washingtonensis (Gillette)
E. calycis Bugbee	Phytophagous in buds of *Pinus banksiana*
E. celtigalla Bugbee	*Phytophaga celtiphylla* Felt
E. cleri Ashmead	*Dendroctonus frontalis* Zimmermann
	D. monticolae Hopkins
	Ips oregoni (Eichhoff)
	Pissodes strobi (Peck)
E. conica Provancher	*Dendroctonus frontalis* Zimmermann
	D. brevicomis LeConte
	Pissodes strobi (Peck)
	Cylindrocopturus longulus (LeConte)
	Phloeosinus dentatus (Say)
	Stephenoderes dissimilis (Zimmermann)
E. contractura Bugbee	*Melanagromyza shineri* (Giraud)
E. crassa Bugbee	*Trypeta* (=*Callachna*) *gibba* (Loew)
	T. (=*Aciurina*) *notata* (Coquilett)
	Dipterous galls on *Ambrosia* species
E. crassineura Ashmead	*Scolytus rugulosus* Ratzeburg
	Magdalis armicollis Say
E. diastrophi Walsh	*Diastrophus cuscutoeformis* (Osten Sacken)
	D. nebulosus (Osten Sacken)
	D. niger Bassett
	Callachna gibba (Loew)
E. discordans Bugbee	*Diplolepis variabilis* (Bassett)
	Periclistus pirata (Osten Sacken)
	Synophromorpha (=*Periclistus*) *sylvestris* (Osten Sacken)
E. dorcaschemae Ashmead	*Dorcaschema alternatum* (Say)
	Phloeotribus frontalis (Oliver)
E. eragrostidis (Howard)	Phytophagous in stems of *Eragrostis poaeoides* and *Agrostis alba*
E. flavicrus Bugbee	Galls on *Nyssa sylvatica*
E. flavicrurensa Bugbee	*Diplolepis polita* (Ashmead) var.
E. flavovultus Bugbee	*Pachypsylla venusta* Osten Sacken
E. fossae Bugbee	*Euura pacifica* (Marlatt)
	E. resinicola (Marlatt)
E. furva Bugbee	*Disholcaspis washingtonensis* (Gillette)
E. fusca Bugbee	*Tachypterellus quadrigibbus* (Say)
	T. q. magnus List
	T. consors Dietz
E. gigantea Walsh	*Eurosta solidaginis* Fitch

E. gossypii Bugbee	*Anthonomus grandis* Boheman
E. illinoisensis Girault	Host relationships unknown, reared in connection with *Harmolita* and from *Elymus* species
E. imminuta Bugbee	*Diplolepis variabilis* (Bassett)
E. incerta Fullaway	*Diplolepis neglecta* (Gillette)
	D. polita (Ashmead)
	D. tuberculator var. *descansonis* Kinsey and Ayres
E. iniquus Bugbee	*Diplolepis neglecta* (Gillette)
E. inornata Bugbee	*Euplilis rufigaster* (Packard) in *Hibiscus* stems
E. juniperinus Marcovitch	Phytophagous in the fruits of *Juniperus virginiana*
E. lacunae Bugbee	From galls of *Protaplonx* species
E. levirultus Bugbee	*Pachypsylla gemma* Riley
E. leso Bugbee	From pine xyelid gall
E. longavena Bugbee	*Diplolepis bicolor* (Harris)
E. lutea Bugbee	From Elecampane
E. lycti Ashmead	*Lyctus striatus* Melsh
E. magdalidis Ashmead	*Anthribus cornutus* (Say)
	Cylindrocopturus longulus (LeConte)
	Magdalis armicollis Say
	Oncideres cingulatus (Say)
E. mali Bugbee	*Tachypterellus quadrigibbus* (Say)
	T. q. magnus List
	T. consors Dietz
E. mammae Bugbee	*Leperisinus aculeatus* (Say)
	Stigmus species
E. minnesota Girault	Phytophagous in *Agropyron* species
E. neomexicana Girault	Reared in connection with *Harmolita*
	Phytophagous in seeds of *Sideranthus spinulosus*
E. nigricoxa Provancher	*Periclistus* species
E. obtusa Bugbee	*Bruchus brachialis* Fahraeus
E. obtusilobae Ashmead	*Diplolepis radicum* Osten Sacken
E. obtusiventris Gahan	*Eurosta solidaginis* Fitch
E. orchidearum (Westwood)	Phytophagous in *Cattleya* species
E. pachyneuron Girault	Phytophagous in *Agropyron repens*, *Elymus canadensis*, and *E. triticoides*
	Parasite of *Harmolita tritici* (Fitch) and *Phytophaga destructor* (Say)
	Galls on *Sitilias grandiflora*
E. parva Phillips	*Harmolita tritici* (Fitch)
	Lepidopterous galls on *Solidago*
	Cephus cinctus Norton
E. phloeotribi Ashmead	*Phloeotribus frontalis* (Oliver)
	P. dentifrons (Blackman)
	Pityophthorus liquidembarus Blackman
	Pseudopityophthorus minutissimus (Zimmermann)
	P. pruinosus (Eichhoff)
	Scolytus muticus Say

	S. *abietis* Blackman
	Stephanoderes dissimilis (Zimmermann)
E. picea Bugbee	*Pissodes sitchensis* Hopkins
E. pini Bugbee	*Acrobasis rubrifasciella* Peck
	Eucosoma scudderiana Clemens
	Pectinophora gossypiella (Saunders)
	Rhyacionia buoliana (Schiffermuller)
	R. frustrana (Comstock)
	R. rigidana (Fernald)
	Thyridopteryx ephemeraeformis (Haworth)
	Epiblema strenuana (Walker)
	Cremastus cookii Weed
E. pissodis Girault	*Pissodes strobi* (Peck)
E. profunda Bugbee (=*E. maculipes* Ashmead)	*Dryorhizaxenus floridanus* (Ashmead)
	Belonocnema treatae Mayr
E. prunicola Walsh	*Amphibolips prunus* (Walsh)
	A. gainesi Bassett
	Philonix fulvicollis Fitch
	Callirhytis seminator (Harris)
E. querci Fullaway	*Acraspis guadaloupensis* (Fullaway)
	Andricus lasius (Ashmead)
E. querci-globuli (Fitch)	*Disholcaspis quercus-globulus* (Fitch)
	D. colorado (Gillette)
	D. mamma (Cresson)
	D. cinerosa (Bassett)
E. rhois Crosby	Phytophagous in seeds of *Rhus typhina*, *R. glabra*, and *R. copallina*
E. sciromatis Bugbee	From cankers on *Pinus taeda* and *P. elliotti* caused by *Cronartium fusiforme*
E. semicircula Bugbee	*Leptostylus gibbulosus*
E. seminis Bugbee	Phytophagous in seeds of *Schmaltzia trilobata*
E. semivena Bugbee	*Pachypsylla vesicula* Riley
E. solenozopheriae Ashmead	*Hemadas nubilipennis* (Ashmead)
E. sphaera Bugbee	*Disholcaspis spongiosa* (Karsch)
	D. quercus-globulus (Fitch)
	D. succinipes (Ashmead)
	D. sileri (Bassett)
E. spina Bugbee	*Diplolepis tuberculator versicolor* Kinsey and Ayres
E. spongiosa Bugbee	*Diplolepis rosae* (Linneaus)
	D. dicholcerus (Harris)
	D. tuberculator (Cockerell)
	D. t. wasatchensis Kinsey and Ayres
E. squamosa Bugbee	Phytophagous in seeds of *Ceanothus divaricatus*
	C. thyraiflorus
	C. cordulatus
	C. velutinus
	C. sanguineus

E. stigmi Ashmead	*Stigmus inordinatus* Fox
E. studiosa Say	*Acraspis pezomachoides* (Osten Sacken)
	A. hirta (Osten Sacken)
	A. erinacei (Beutenmuller)
	A. macrocarpae Bassett
	A. villosa Gillette
	A. derivatus (Kinsey)
	A. ozark (Kinsey)
	A. gemmula (Bassett)
	Andricus ignotus (Bassett)
	A. cicatricula Bassett
	A. flocci (Osten Sacken)
	Callirhytis elongata (Kinsey)
	C. clavula (Osten Sacken)
	C. seminator (Harris)
	Disholcaspis spongiosa (Karsch)
	D. washingtonensis (Gillette)
	D. quercus-globulus (Fitch)
	D. succinipes (Ashmead)
	D. sileri (Bassett)
	D. colorado (Gillette)
	Dryocosmus palustris (Ashmead)
	Philonix fulvicollis Fitch
	Sphaeroteras melleum (Ashmead)
	Xentholeras eburnea (Bassett)
E. terrea Bugbee	*Diplolepis polita* (Ashmead) var.
E. tomici Ashmead	*Tomicus* (=*Pityogenes*) *plagiatus* (LeConte)
	Cylindrocopturus eatoni Buchanan
	C. furnissi Buchanan
	C. longulus (LeConte)
	Epiblema strenuana (Walker)
	Phloeosinus species
E. tumoris Bugbee	Phytophagous in stems of *Pinus sylvestris*
E. tylodermatis Ashmead	*Tyloderma foveolatum* Say
	Coleophora malivorella Riley
	Mompha eloisella (Clemens)
	Trichobaris texana LeConte
	T. trinotata (Say)
	Lixus scrobicollis Boheman
	L. musculus Say
E. vernonia Bugbee	*Tephritis* (=*Neotephritis*) *finalis* Loew
	Trypetid seed maggots in *Vernonia interior*

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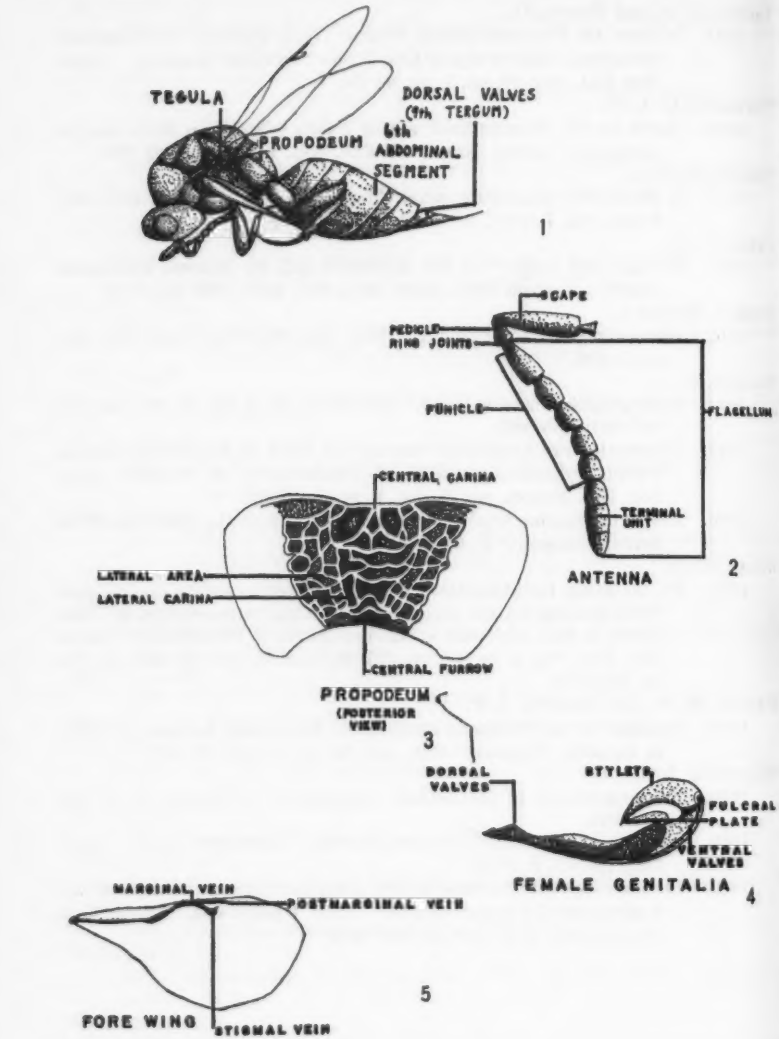

FIGURES 1–5.—*Eurytoma pissodis* Girault, female: 1, lateral view; 2, antenna, lateral view; 3, propodeum, posterior view; 4, genitalia, lateral view; 5, forewing, dorsal view.

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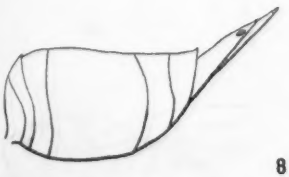

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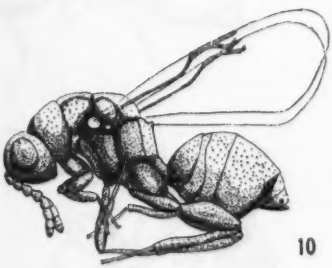

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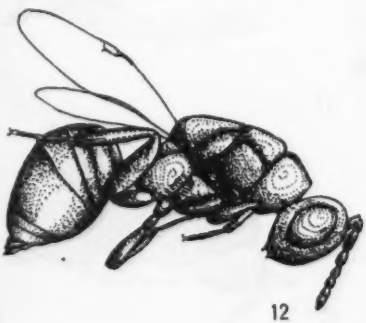

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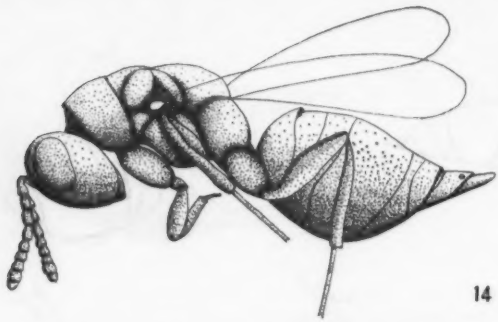
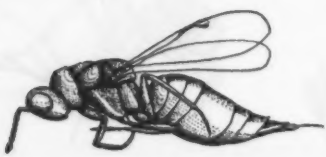
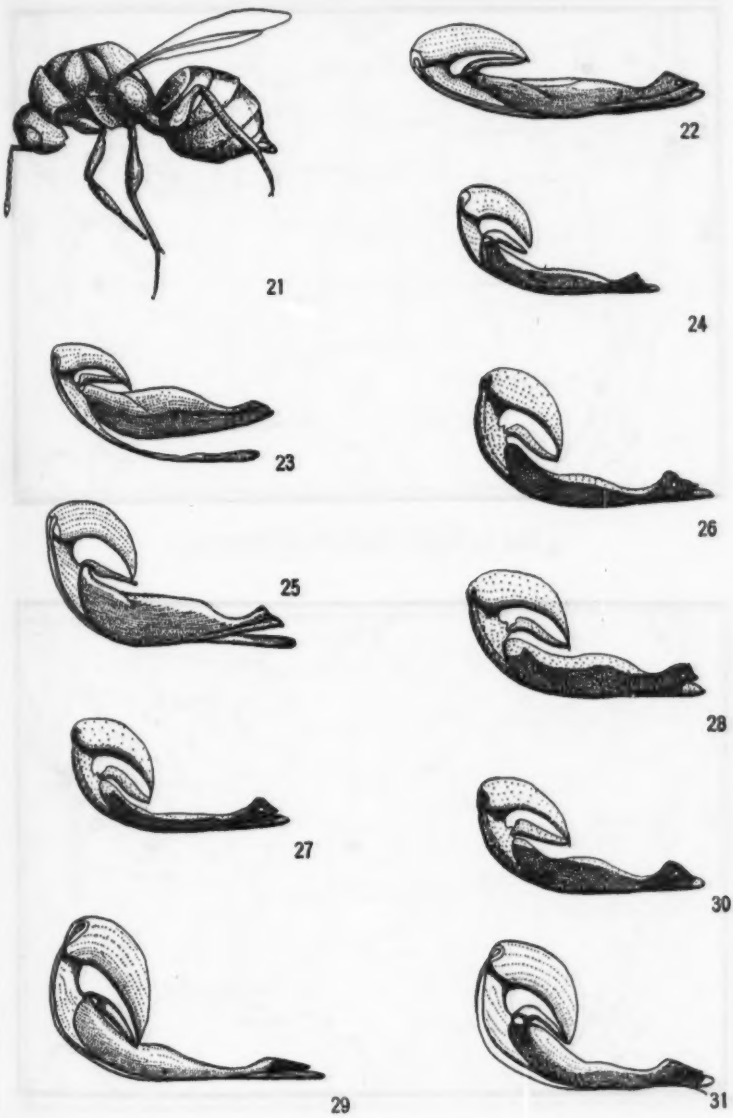
FIGURES 6–13.—Female, lateral view: 6, *Eurytoma pachyneuron*, abdomen; 7, *E. gigantea*, abdomen; 8, *E. contractura*, new species, abdomen; 9, *E. conica;* 10, *E. mammae*, new species; 11, *E. fossae*, new species; 12, *E. semicircula;* 13, *E. contractura*, new species.

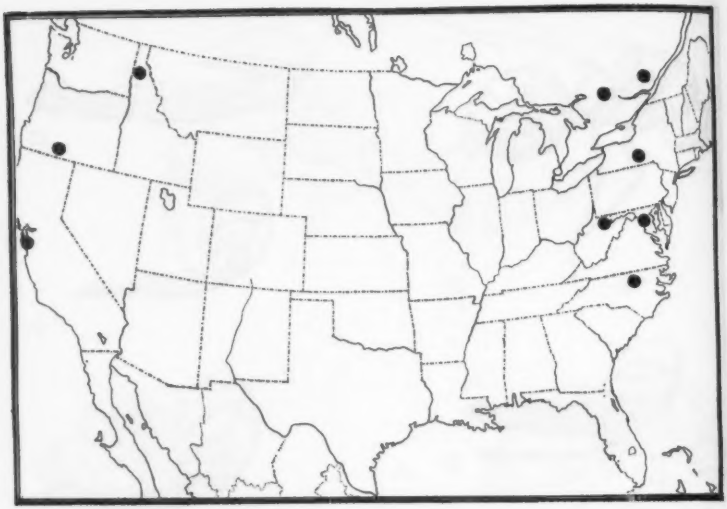




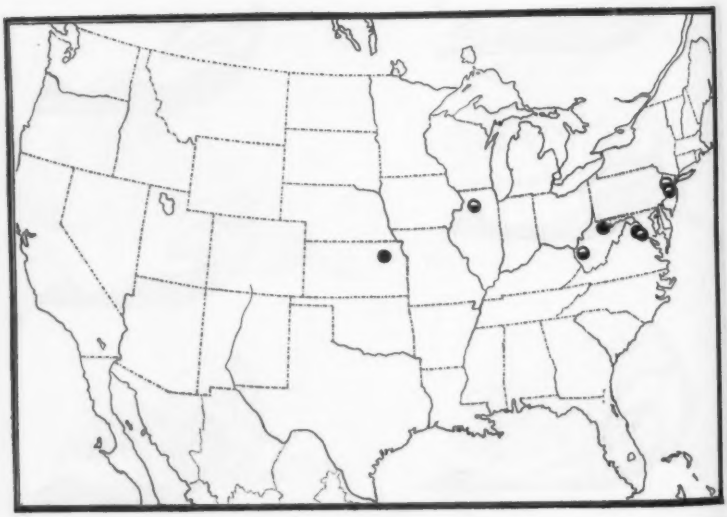
FIGURES 14–20.—New species, female, lateral view: 14, *Eurytoma lutea;* 15, *E. vernonia;* 16, *E. crassa;* 17, *E. sphaerae;* 18, *E. mali;* 19, *E. flavicrus;* 20, *E. squamosa.*



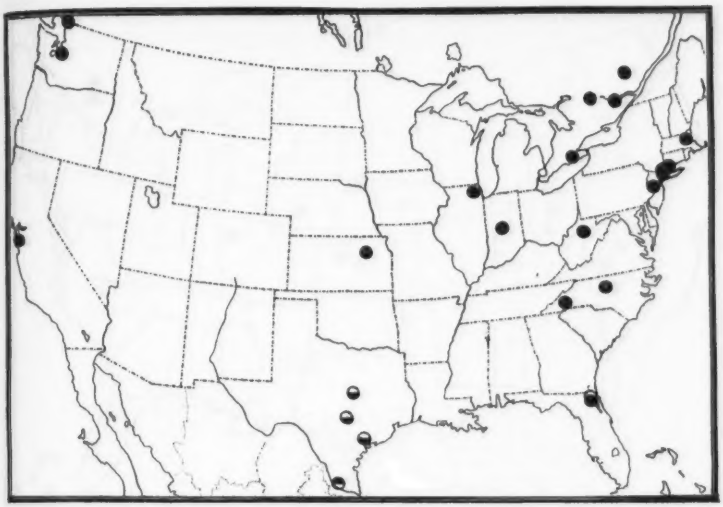
FIGURES 21–31.—New species, female, lateral view: 21, *Eurytoma altifossa.* Genitalia: 22, *E. semicircula;* 23, *E. altifossa;* 24, *E. fossae;* 25, *E. crassa;* 26, *E. baccae;* 27, *E. mali;* 28, *E. obtusa;* 29, *E. flavicrus;* 30, *E. tylodermatis;* 31, *E. contractura.*



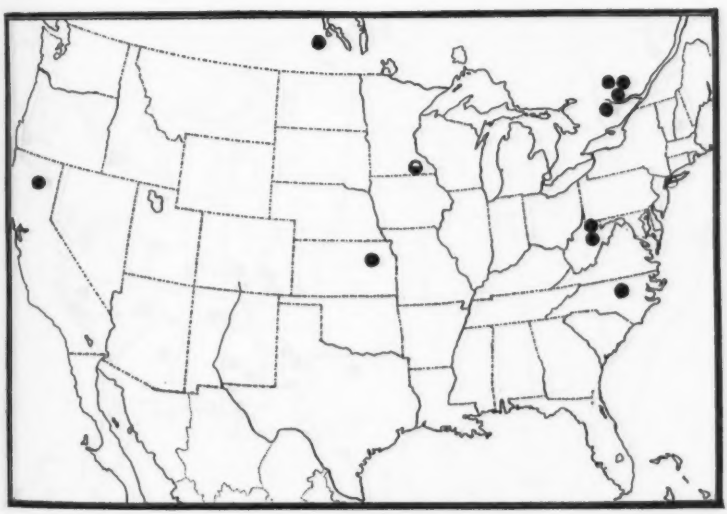
MAP 1.—Locality records for *E. phloeotribi*.



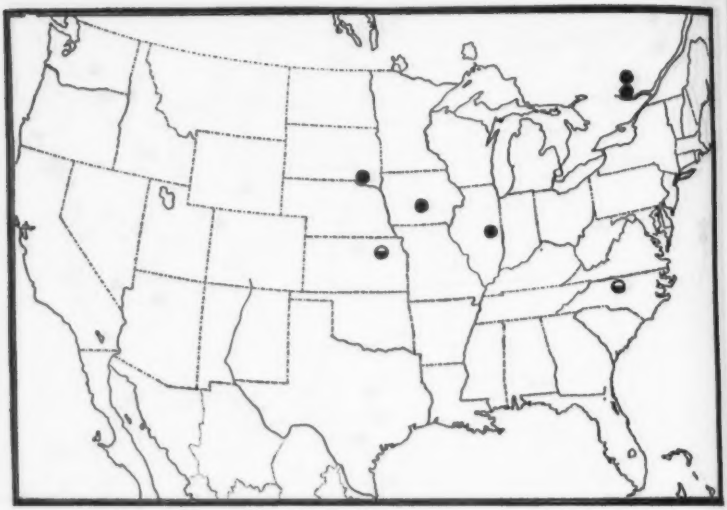
MAP 2.—Locality records.
E. mammae ◒ *E. lycti* ●



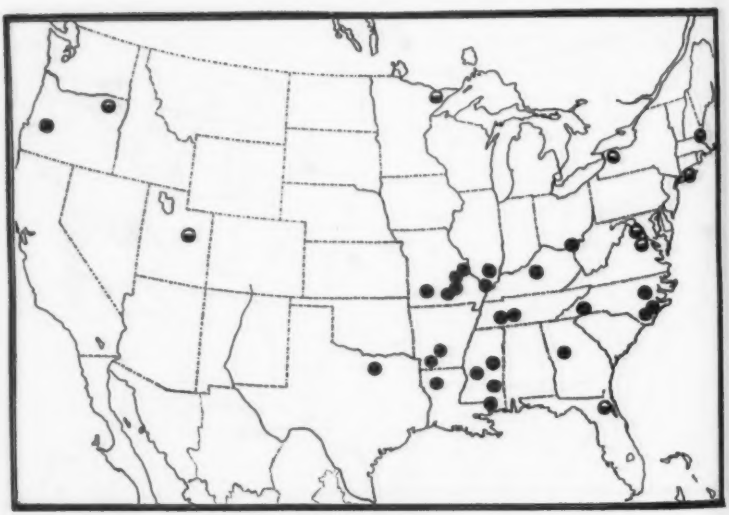
MAP 3.—Locality records.
E. semicircula ◓ *E. profunda* ◒ *E. conica* ●



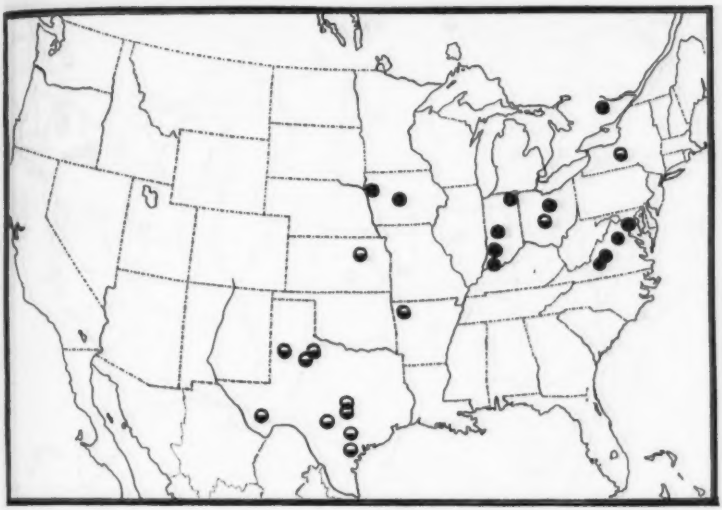
MAP 4.—Locality records.
E. magdalidis ● *E. minnesotae* ◒



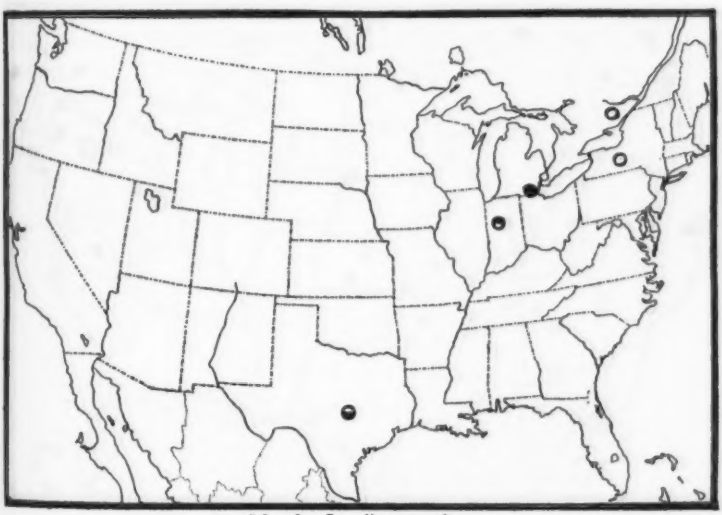
MAP 5.—Locality records.
E. illinoisensis ● *E. dorcaschemae* ◒



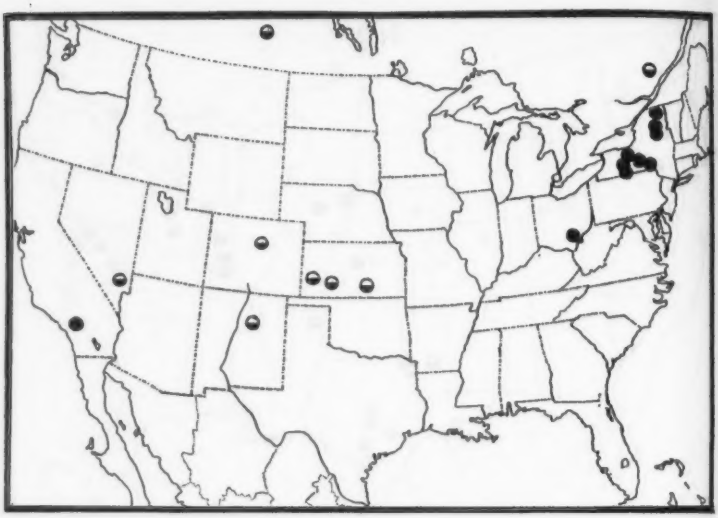
MAP 6.—Locality records.
E. sphaera ● *E. obtusilobae* ◒



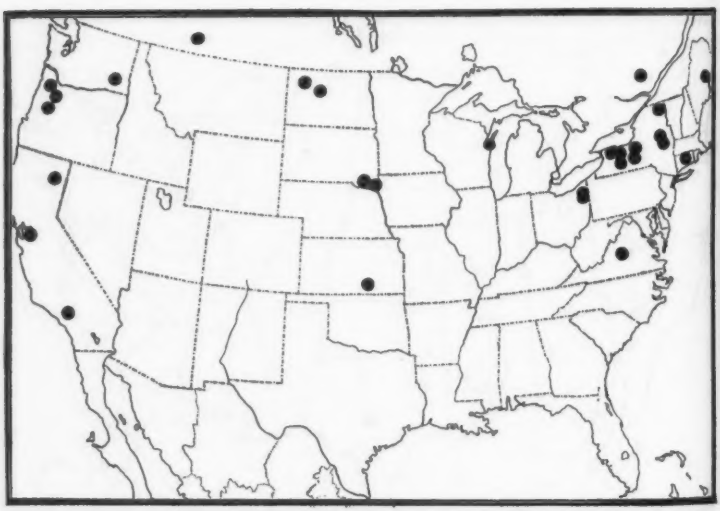
MAP 7.—Locality records.
E. semivena ◒ *E. bicolor* ●



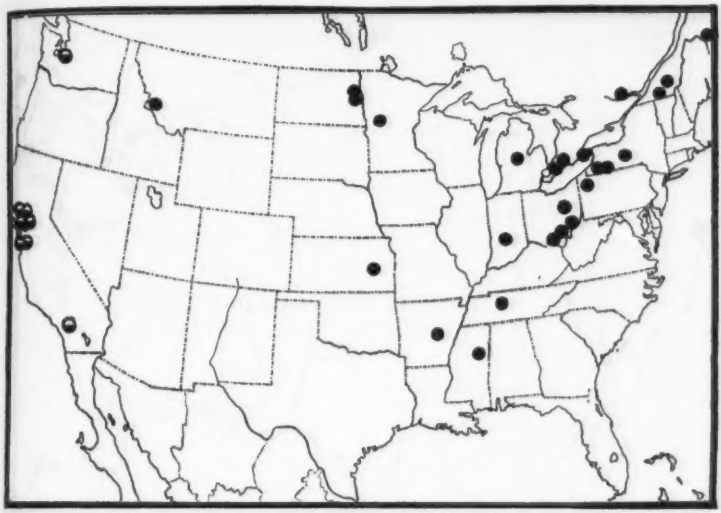
MAP 8.—Locality records.
E. flavovultus ◒ *E. lutea* ● *E. juniperinus* ○ *E. eragrostidis* ◓



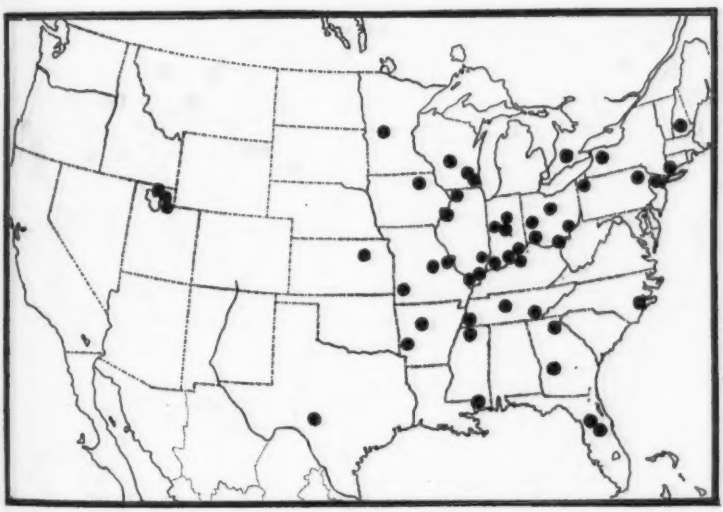
MAP 9.—Locality records.
E. bromi ● *E. neomexicana* ◒



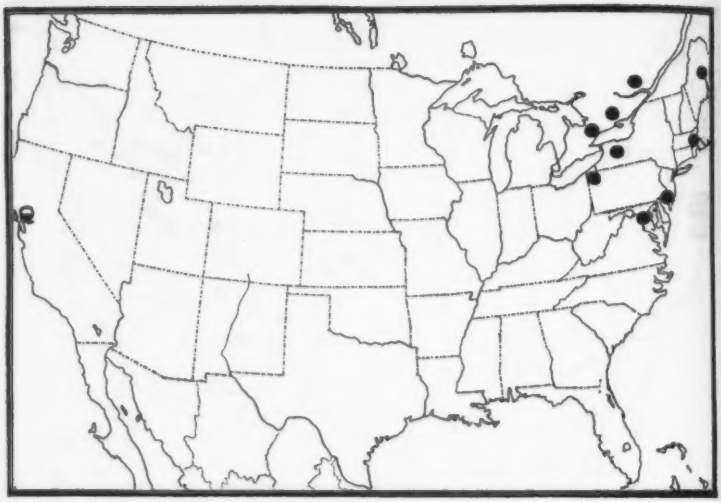
MAP 10.—Locality records for *E. pachyneuron*.



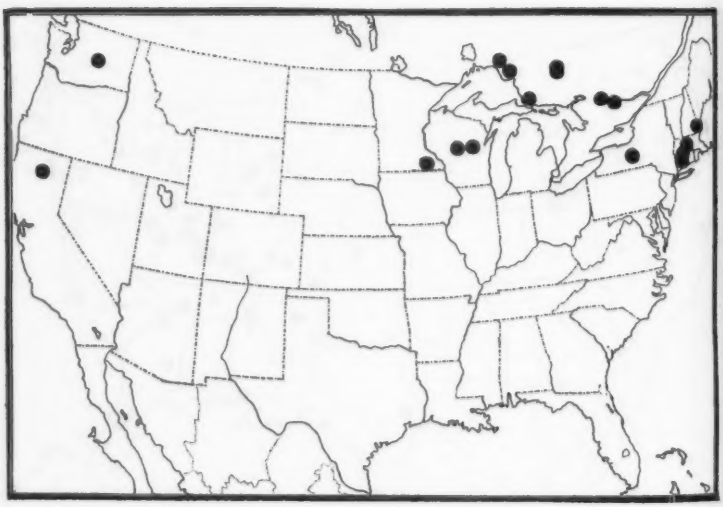
MAP 11.—Locality records.
E. californica ◒ *E. gigantea* ●



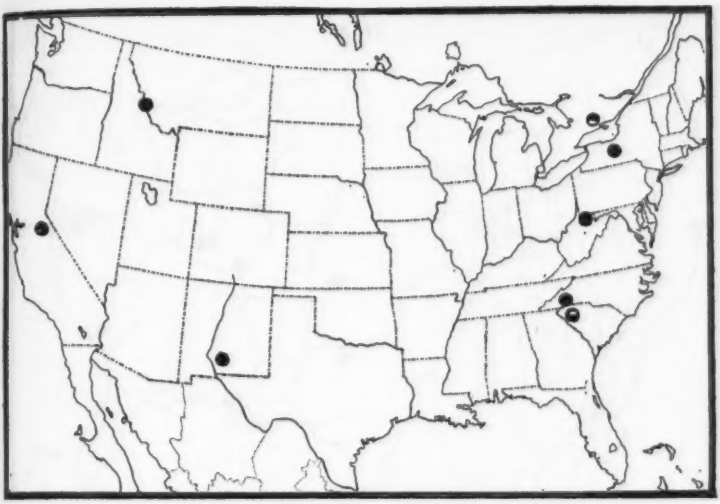
MAP 12.—Locality records for *E. querci-globuli*.



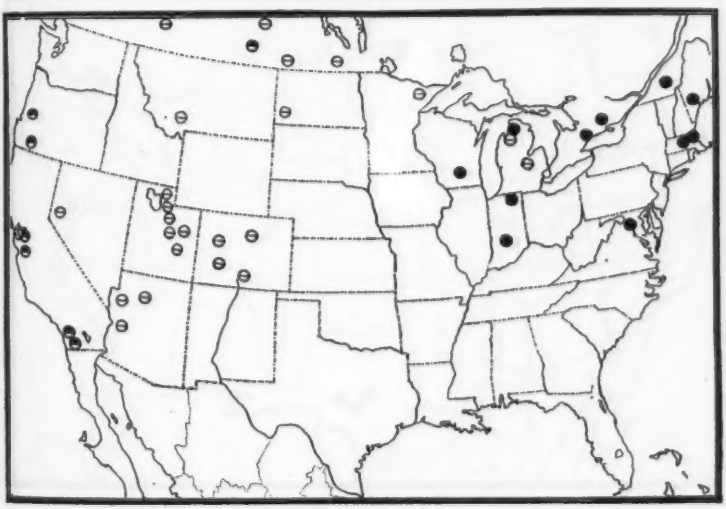
MAP 13.—Locality records.
E. solenozopheriae ● *E. furva* ◒



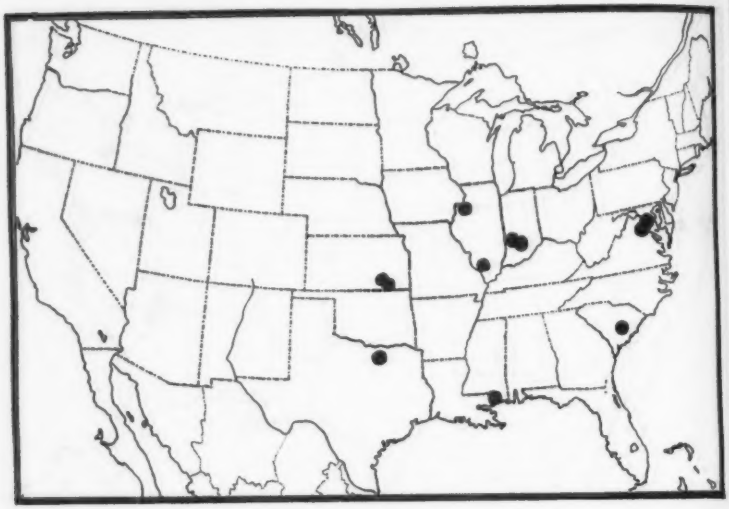
MAP 14.—Locality records for *E. pissodis*.



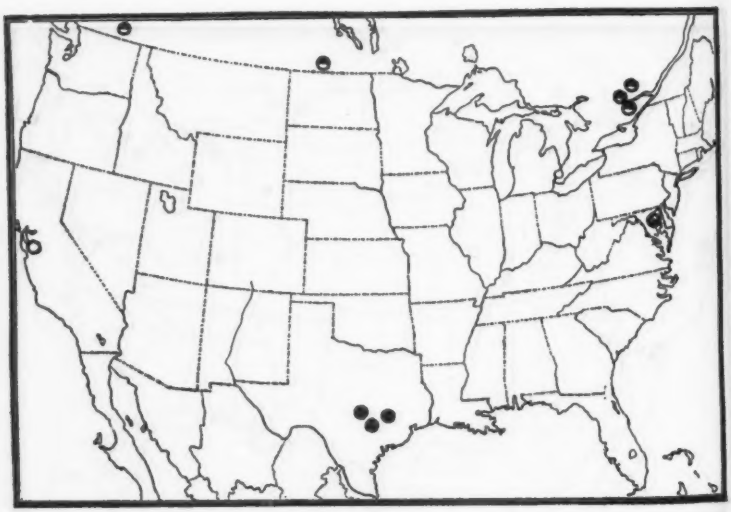
MAP 15.—Locality records.
E. cleri ● *E. flavicrus* ◒ *E. contratura* ◓



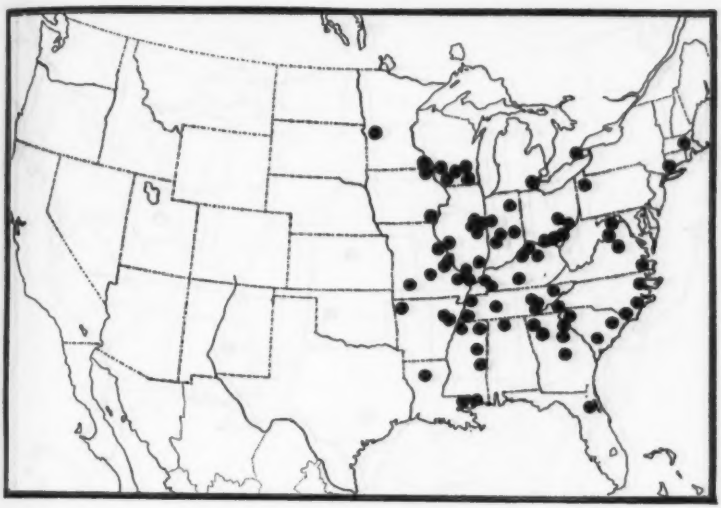
MAP 16.—Locality records.
E. discordans ● *E. acuta* ⊖ *E. incerta* ◓



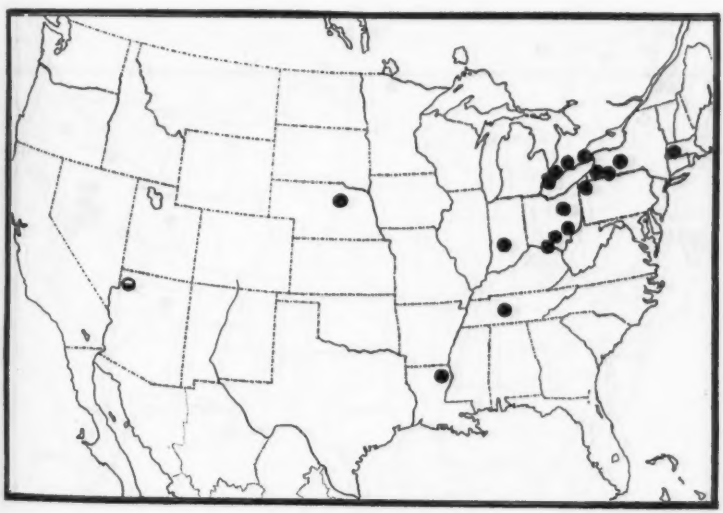
MAP 17.—Locality records for *E. prunicola*.



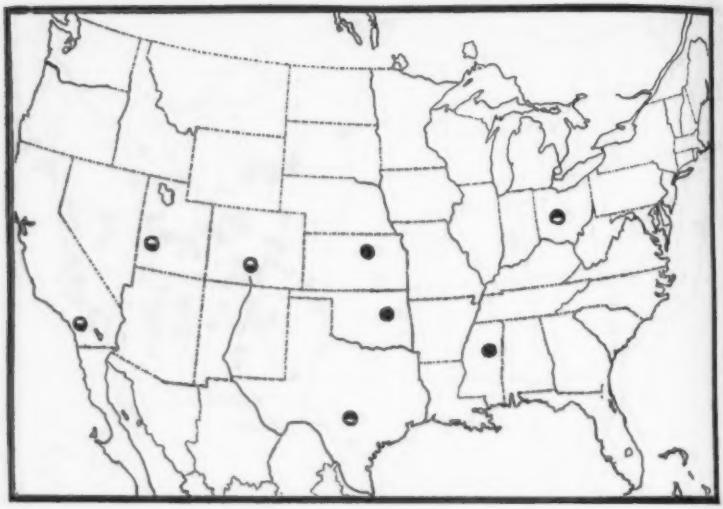
MAP 18.—Locality records.
E. celtigalla ● *E. lacunae* ◒ *E. nigricoxa* ◓ *E. querci* ○



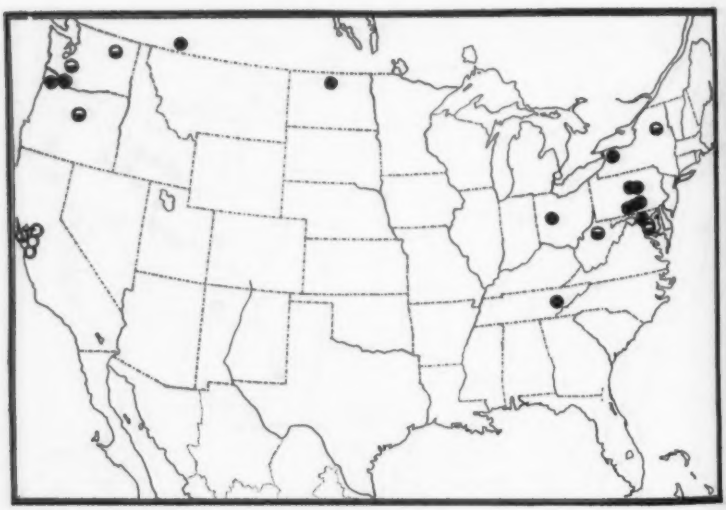
MAP 19.—Locality records for *E. auriceps*.



MAP 20.—Locality records.
E. brevivena ◒ *E. oblusiventris* ●

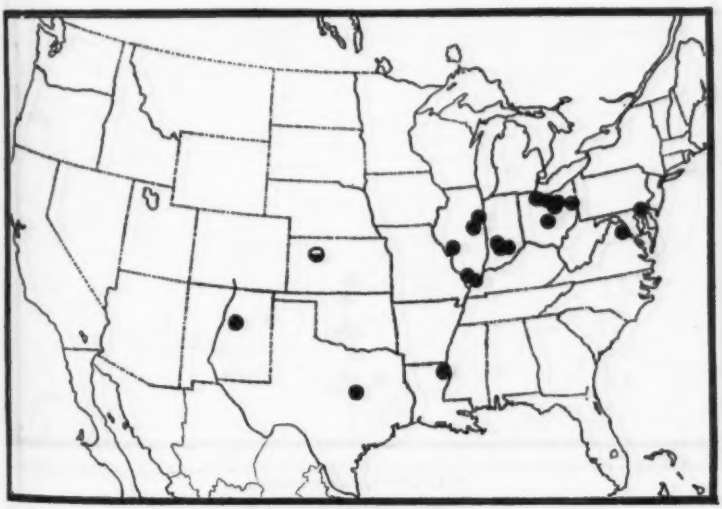


MAP 21.—Locality records.
E. vernonia ● *E. bigeloviae* ◒ *E. levivultus* ◓

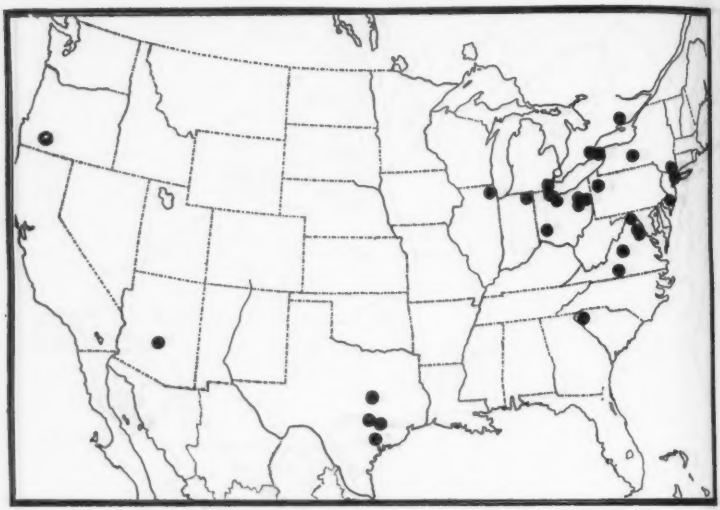


MAP 22.—Locality records.
E. atripes ● *E. fossae* ○ *E. tomici* ◒

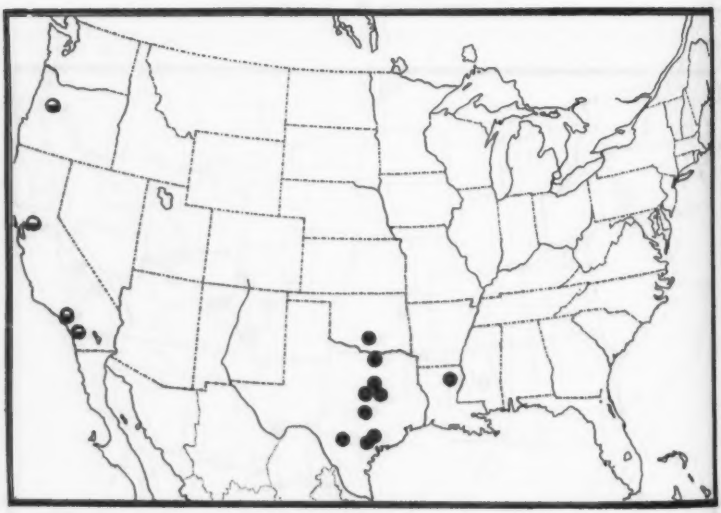
MAP 23.—Locality records.
E. appendigaster ● *E. altifossa* ◒



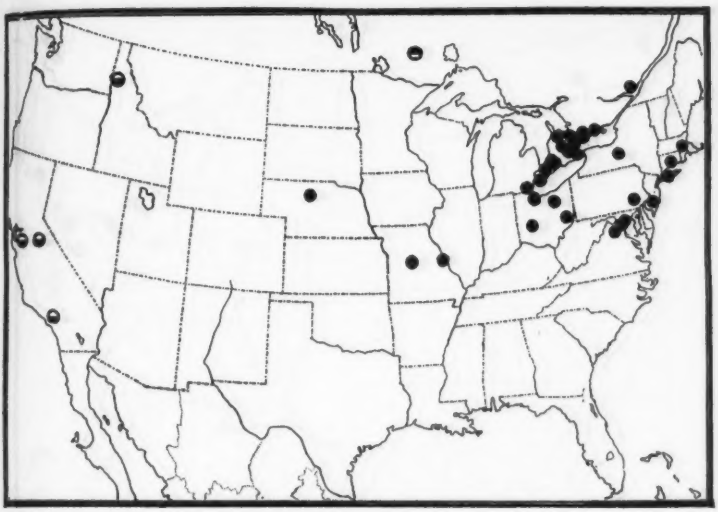
MAP 24.—Locality records.
E. crassa ● *E. seminis* ◒



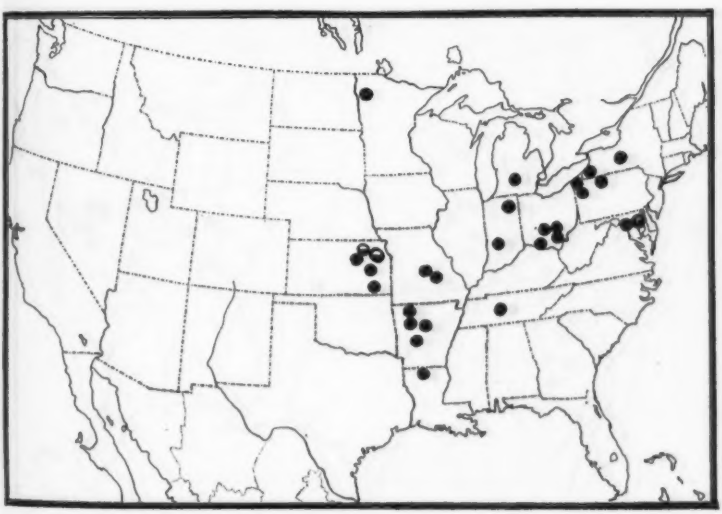
MAP 25.—Locality records.
E. tylodermatis ● *E. terrea* ◒



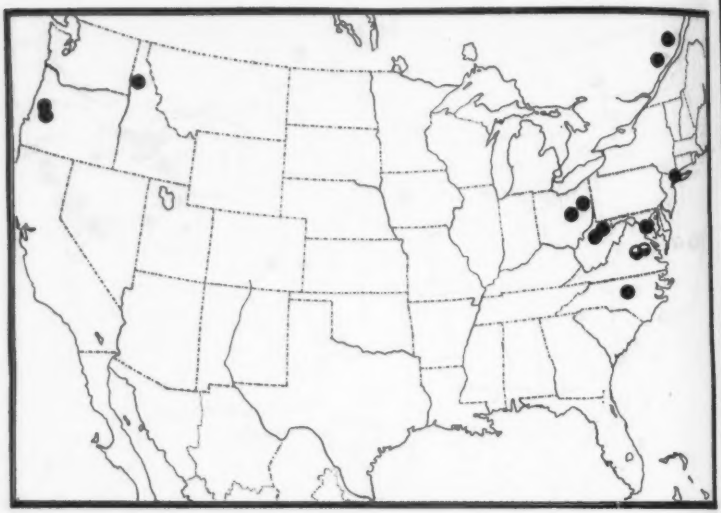
MAP 26.—Locality records.
E. stigmi ◒ *E. gossypii* ●



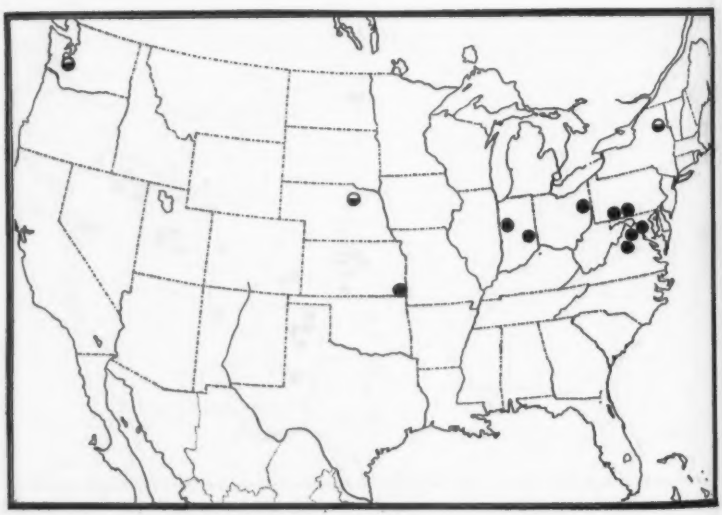
MAP 27.—Locality records.
E. squamosa ◒ *E. calycis* ◓ *E. pini* ●



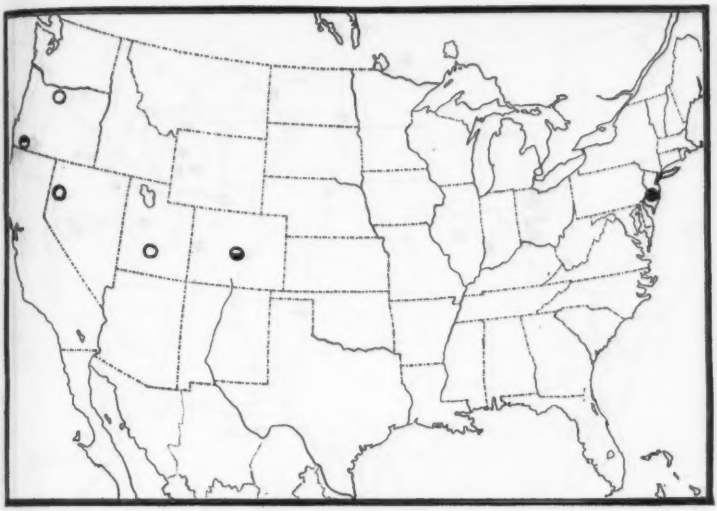
MAP 28.—Locality records.
E. baccae ◒ *E. rhois* ●



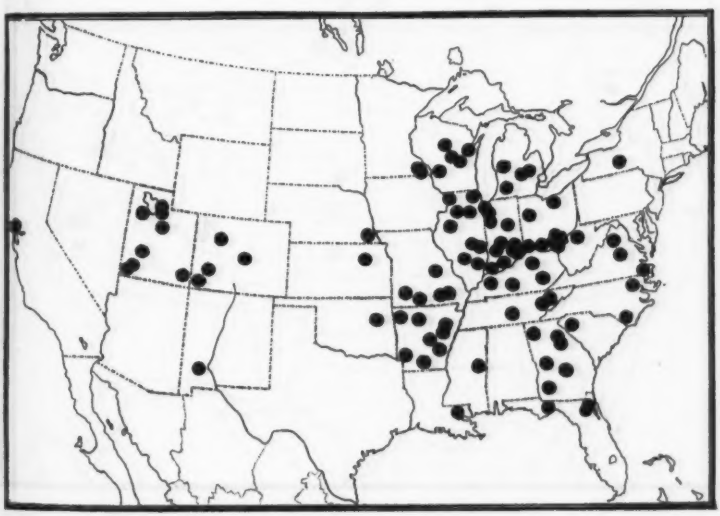
MAP 29.—Locality records.
E. levo ◒ *E. crassineura* ●



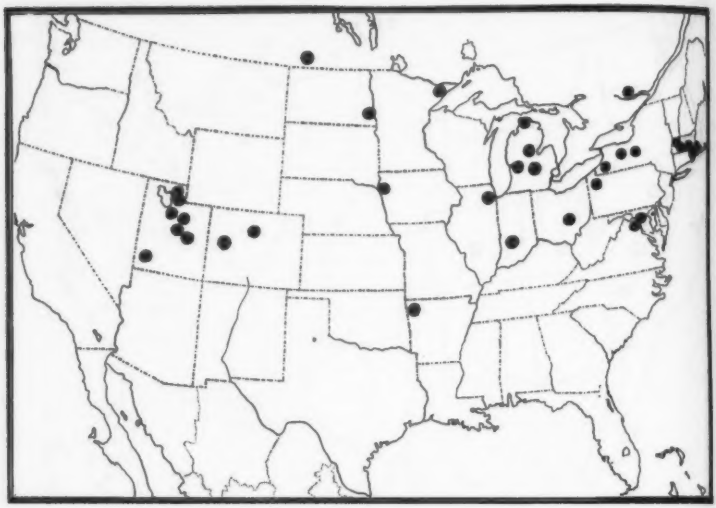
MAP 30.—Locality records.
E. parva ● *E. fusca* ◒



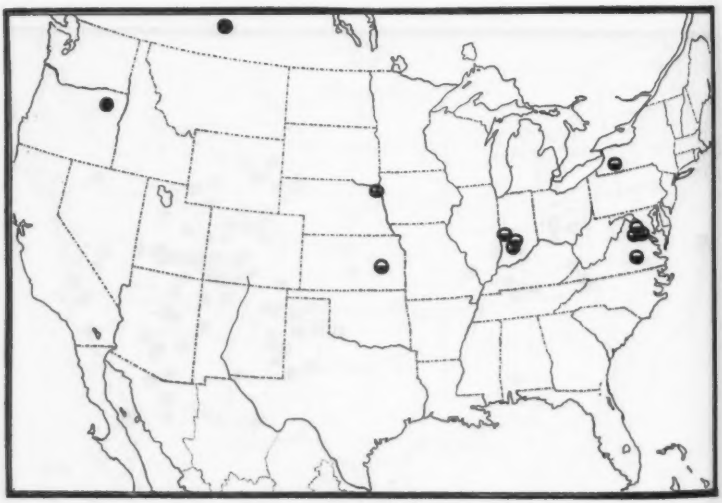
MAP 31.—Locality records.
E. iniquus ◒ *E. flavicrurensa* ◓ *E. oblusa* ● *E. imminuta* ○



MAP 32.—Locality records for *E. studiosa*.

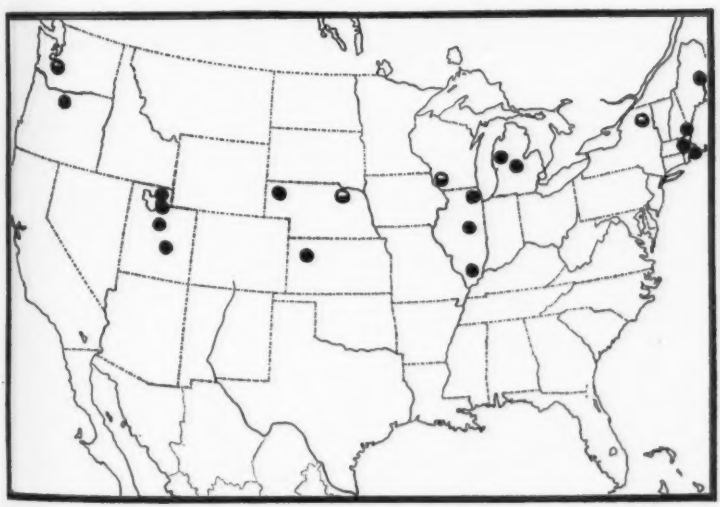


MAP 33.—Locality records for *E. spongiosa*.

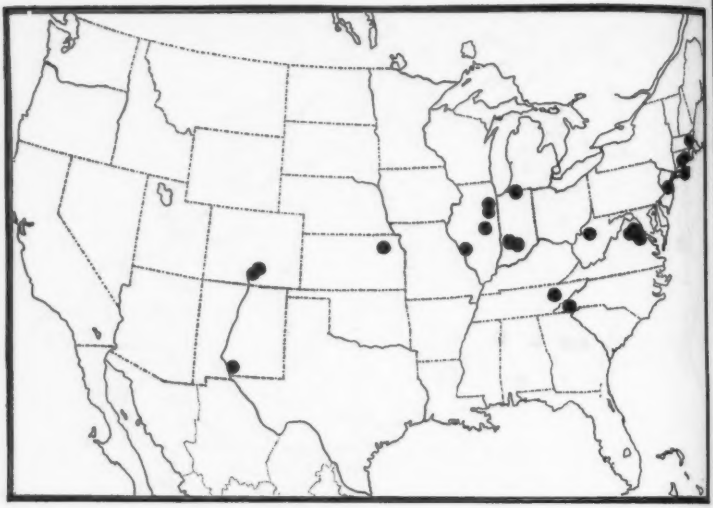


MAP 34.—Locality records.
E. bolteri ◒ *E. spina* ●

MAP 35.—Locality records.
E. dorcaschemae ◒ *E. parva* ● *E. longavena* ◓ *E. picea* ○



MAP 36.—Locality records.
E. calcarea ● *E. mali* ◒



MAP 37.—Locality records for *E. diastrophi*.

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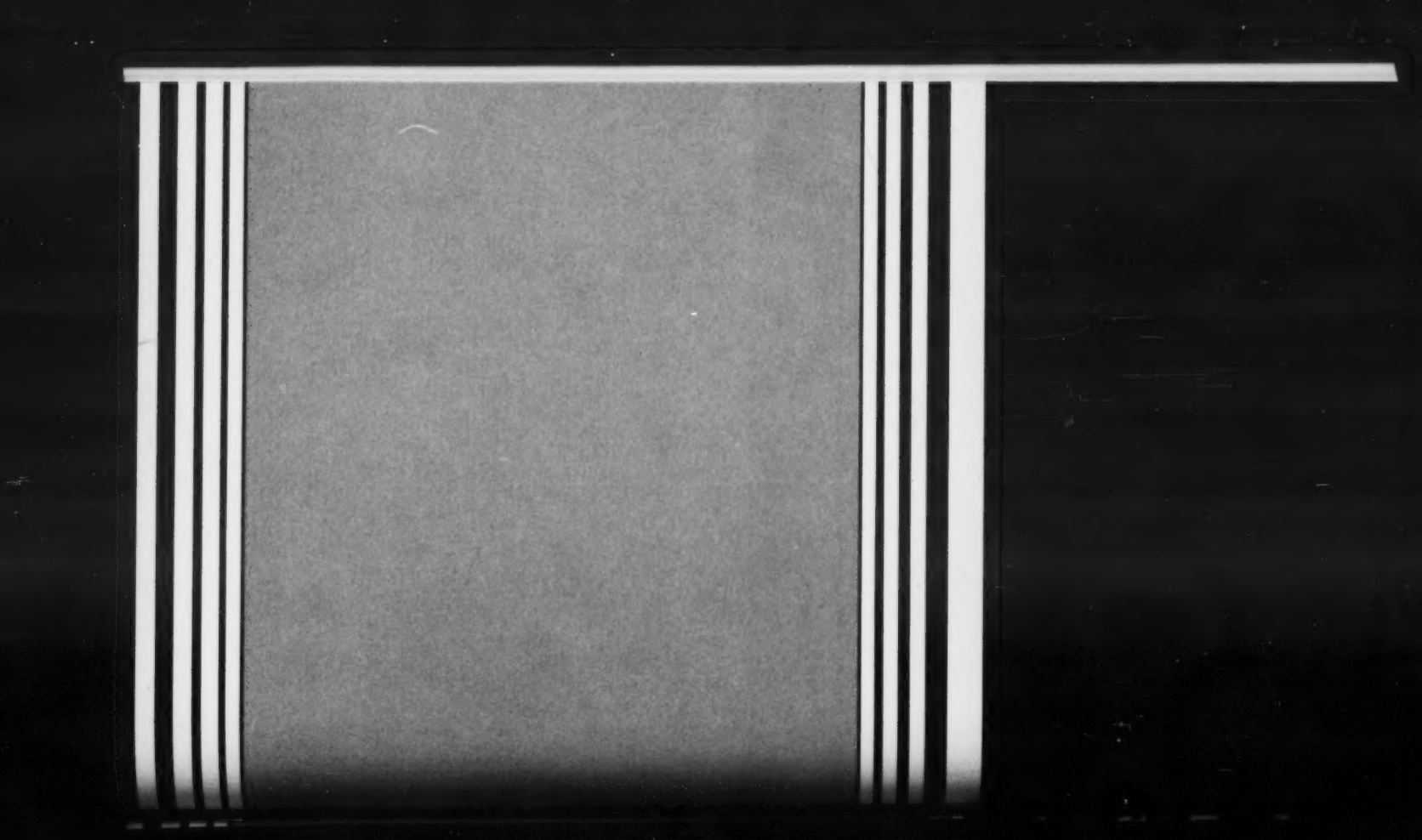

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By MILDRED STRATTON WILSON and JERRY C. TASH

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THE EURYHALINE COPEPOD GENUS EURYTEMORA IN FRESH AND BRACKISH WATERS OF THE CAPE THOMPSON REGION, CHUKCHI SEA, ALASKA

By MILDRED STRATTON WILSON and JERRY C. TASH [1]

Collections made in the vicinity of Cape Thompson, Alaska, on the coast of the Chukchi Sea during the course of biological investigations by the Atomic Energy Commission (Project Chariot), have yielded six species of the euryhaline copepod genus *Eurytemora*. These occurred in brackish waters (coastal lagoons, pools, and ponds) and in fresh waters (inland lakes, pools, ponds, and pools and ponds near the coast). Collections were made in 1959 by Douglas Hilliard and in 1950–1961 by J. C. Tash. These data partly supplement those of Johnson (1961) who collected from some of the lagoons in 1959. Additional data come from samples from other regions of Alaska accumulated by M. S. Wilson and referred to herein as the Wilson collection. Reports on other copepods and crustacean groups of the Cape Thompson collections are included in papers by Wilson and Tash (MS.) and Hilliard and Tash (1966).

Financial support of the Atomic Energy Commission for field work in 1959 by Douglas Hilliard and in 1960–1961 by J. C. Tash, and of the National Science Foundation for studies by M. S. Wilson (grant

[1] Wilson: Arctic Health Research Center, U.S. Public Health Service, Anchorage, Alaska; Tash: U.S. Public Health Service, Klamath Lake Project, Klamath Falls, Oregon.

G 21643 to the Smithsonian Institution) is acknowledged. We are indebted to Mr. Hilliard for collections, some physical data and critical reading of the manuscript, and to Miss Gayle Heron for making available, prior to publication, a copy of her paper (Heron, 1964).

Inland Lakes, Pools, and Ponds

Only one species of *Eurytemora*, new to science, occurred in samples from 4 of 10 small, shallow, permanent, unnamed bodies of fresh water (herein termed lakes) and 7 nearby smaller, less permanent pools and ponds situated in wet *Carex* marsh and meadow. One lake (reference no. 9), located about 11 miles inland from Cape Thompson, has an outlet to a small creek draining to the Kukpuk River. The other three lakes, located near one another about 7 miles inland, have no defined inlets or outlets, the incoming water originating from drainage of the surrounding marsh during snowmelt and rains. Emergent vegetation occurs at the edges of the lakes; in the type locality (Lake 4), broad-fingered beds of *Arctophila* extend toward the center. The lakes are ice-free for about 2½–3 months of the year (from early to mid-June to early September). In 1960, the maximum temperature range recorded weekly for Lake 4 from July 1 to August 11 was 13.2–15.5° C.; by September 4, this dropped to 4° C.

Quantitative and qualitative samples were taken at regular intervals and stations from the open, deep water of Lake 4 with no. 12-mesh plankton nets on an open Clarke-Bumpus sampler. The other lakes were sampled on one or two dates by casting nets from the shore.

The existence of the new species, described below, has been known for many years from immature copepodid stages collected at Umiat (Wilson collection) but it was impossible to define until adults were collected in the Cape Thompson samples. The Umiat collection and one made by Tash in the Noatak region extend the known distribution of the species beyond the Cape Thompson region.

Family Temoridae

Eurytemora arctica, new species

FIGURES 1–3

TYPE LOCALITY.—Unnamed lake (reference no. "Lake 4"), about 7 miles inland from coast of Chukchi Sea, Cape Thompson region, Alaska, 68°11′09″ N., 165°42′05″ W.; surface area, 2.1 hectares; maximum depth, 2.4 meters.

TYPES.—Holotype ♀, USNM 106647; allotype ♂, USNM 106648.

DEFINITION.—Female: Metasomal wings and genital segment not laterally expanded; caudal rami slightly longer than urosome segments 2 + 3; antennules reaching to near end of metasome. Leg 5: Exopod

segment 1 with 2 outer spines; inner process directed inwards and about 4 × width of distal part of segment; inner apical spine of exopod 2 much longer than outer apical spine. Male: Antennules a little longer than metasome, with stout, long aesthetes; spines of segments 8–12 of right antennule not more developed than those of left. Leg 5 of adult: Right exopod 2 constricted near middle with basal part wider than distal; anterior proximal part of left basal segment 2 produced into spinous point; left exopod 2 without apical digitiform protrusion. Leg 5 of copepodid stage V: Inner apical spine of exopod 2 much longer than outer spine, that of left side the longer, equaling half or more of the length of its segment.

DESCRIPTION OF FEMALE.—Total length: 1.85–2.02 mm. (metasome = total anterior division, 1.09–1.16; urosome, 0.765–0.855; measurements middorsal line, top of head to end of caudal rami, from specimens in which urosome was separated and mounted in shallow depression slide to overcome effect of ventral curvature). All segments of metasome well defined (figs. 1*a*, *b*); greatest width in second segment (thoracic somite 1) equal to about one-half total length of metasome. Cephalic segment rounded anteriorly, slightly broadened at midpoint, without pronounced cephalic depression (viewed laterally in exact midline); dorsal cuticular protuberance at distal midpoint of segment, variable in size and prominence (fig. 1*a*). Last 2 segments of metasome reduced in both width and length (fig. 1*b*); wings of last segment not expanded laterally, nearly symmetrical, produced posteriorly to near midpoint of genital segment, apices rounded and each bearing a fine, sensory setule (figs. 1*c*, *d*).

Urosome (figs. 1*d*, *e*): Genital segment rounded laterally in proximal half but without prominent protrusions either laterally or ventrally; operculum (external genital flap) broader than long, rounded distally, partially encircled by depressed cuticular ornamentation of narrow, lobed sclerotizations armed with short setules (fig. 1*e*). Segments 2 and 3 with lateral hairs that extend over distal outer portion of dorsal surface of segment 3. Caudal rami a little longer than segments 2 + 3 (about 1.13:1); widest just below base, length about 6 × this greatest width; inner and outer margins with fine hairs and dorsal surfaces with closely placed, short, scalelike hairs. Terminal caudal setae (except short, dorsally placed seta) slender, unjointed, longer than rami; lateral seta a little shorter, plumose only on inner margin; second apical seta (from outer margin) the longest.

Antennule (fig. 1*g*) reaching to about middle of metasomal wings or a little beyond; 24-segmented (counting imperfectly separated segments 8–9); beginning with 12, the segments regularly elongated;

numerical setation as common in the genus (s=seta; sp=spine; a=aesthete).

segment		segment	
1	3s, a	13	2s
2	3s, a	14	2s, a
3	2s, a	15	2s
4	1s	16	2s, a
5	2s, a	17	2s
6	1s	18	2s
7	2s, a	19	2s, a
8	sp	20	1s
9	2s, a	21	1s
10	sp	22	1s + 1s
11	2s, a	23	1s + 1s, a
12	1s, a, sp	24	6s, a

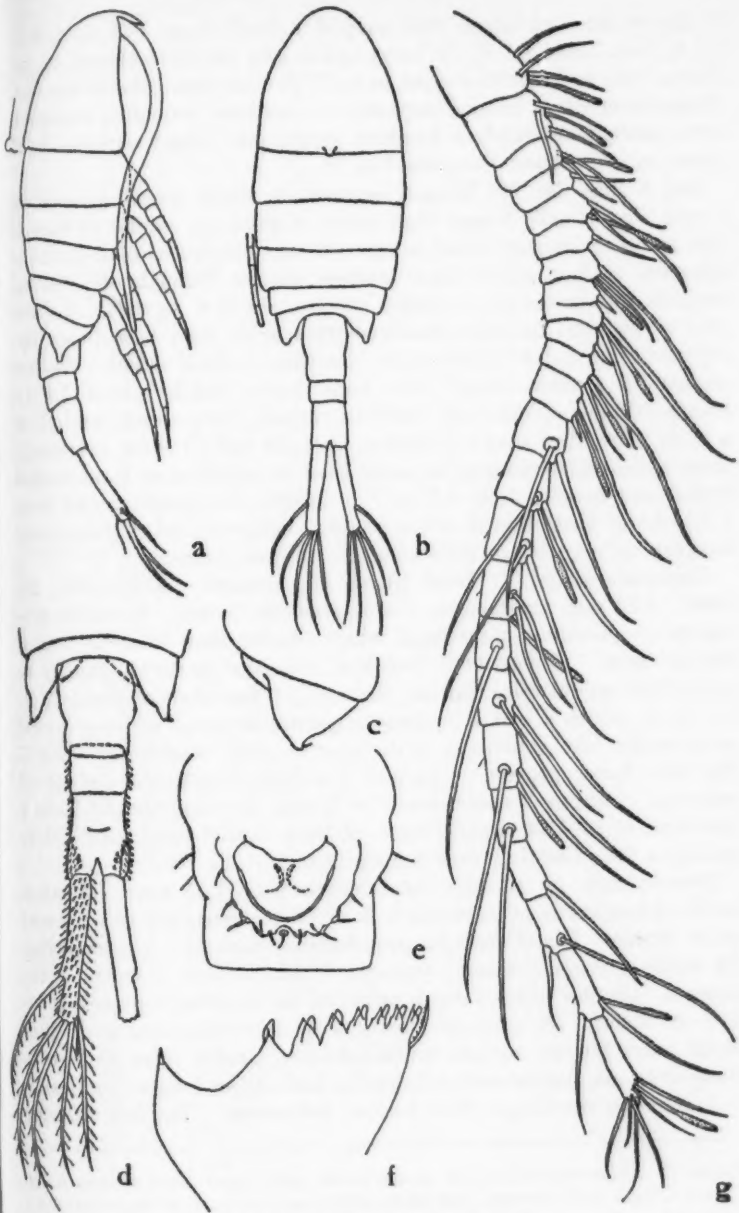
Aesthetes subequal to short setae of proximal segments but much shorter than long setae of other segments; most setae of segments 7–20 very long, reaching end of succeeding 3 segments or beyond; those of segments 17, 19, and 20 the longest; many segments with irregularly placed hairs.

Mandible blade (fig. 1*f*) with prominent, incompletely rounded gap separating first denticle from others; second denticle single, with hyaline cap; others with doubled or tripled points of which one carries a hyaline cap. Antenna and other cephalic appendages as typical for the genus.

Legs 1–4 (figs. 2*d–g*) comparatively elongate (fig. 1*a*). Segmentation and setation as typical for the genus, all setae plumose (not completely illustrated in figures). Basal segment 1 of all legs with inner seta; basal segment 2 with slender outer seta on legs 3–4. Leg 1: Exopod segment 3 only a little longer than exopod 1, with 3 spines and 4 setae, apical spines with hyaline membranes, innermost spine subequal to or a little shorter than segment, apical seta usually reaching considerably beyond apical spine; endopod 1-segmented, with 6 setae, the apical reaching to end of exopod 3 or beyond.

Legs 2–4: Exopod segment 3 with 3 spines and 5 setae; endopods 2-segmented, second segment with 6 setae in legs 2–3 and 5 setae in leg 4, all apical setae reaching beyond exopod 3. Exopod segment 3 of legs 2–3 shorter than exopod segments 1 + 2 (about 1:1.24; range 1:1.21–1.31), that of leg 4 subequal to segments 1 + 2 (1:1.08); inner apical spine of leg 2 a little shorter than or subequal to exopod

FIGURE 1.—*Eurytemora arctica*, new species, female: *a*, habitus, lateral view; leg 5 omitted (Lake 4), and variation of cephalic protuberance (Lake 8); *b*, habitus with apex of antennule, dorsal view (Lake 4); *c*, detail of right metasomal wing, lateral view; *d*, detail of metasomal wings and urosome, dorsal view; *e*, genital segment, ventral view, with detail of operculum; *f*, mandible, apex of blade; *g*, antennule.



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3, that of legs 3–4 longer than exopod 3 (leg 3, from 1.02 to 1.10:1; leg 4, from 1.08 to 1.17:1); inner apical seta reaching almost to end of or a little beyond inner spine in leg 2, shorter than spine in legs 3–4. (Measurements of exopod segments in midline, exopod 1 measured from exact base which is inserted deeply into basal segment 2; in above ratios, exopod 3 expressed as 1).

Leg 5 (figs. 2*a*, *b*): Exopod segment 1, outer spines variable in length, first usually longer than width of segment, second as long as first spine or shorter; outer margin of segment constricted distad to insertion of first spine; inner process slender throughout, directed inwards, tip upcurved and finely serrate, about 4 × width of distal part of segment (process measured from notch near base to its tip; segment from notch of process to insertion of distal spine). Exopod segment 2 slender, length less than twice width (about 1.7:1); length of outer apical spine variable, ranging from about one-half to a little more than that of segment (figs. 2*a* and 2*b* show extremes); inner apical spine elongate, shorter than or subequal to total exopod length and ranging from 5.6 to 7 × length of segment 2 and from 3.2 to 4.8 × that of outer spine; segment not produced to sharp point between spines, with or without setule on inner margin.

Copepodid stage V: Total length (1 specimen, Lake 4, July 28, 1960): 1.72 mm. (metasome, 1.025; urosome, 0.695). Cephalic protuberance present. Metasomal wings shorter than in adult but of similar form. Proportional length of urosome segments similar to adult, but caudal rami shorter, their length less than segments 2 + 3 (0.8:1), width about 4 × length; genital segment without lateral protrusions. Antennules a little shorter than metasome. Leg 5 (fig. 2*b*): Inner process of exopod 1 a little longer than width of segment. Length of specimens from Umiat less than that of Lake 4 specimen (1.32–1.43 mm.); length of their caudal rami subequal to or only a little less than urosome segments 2 + 3.

DESCRIPTION OF MALE.—Total length: 1.56–1.65 mm. Greatest width of metasome in segments 2–3; distal segments not so narrowed as in female. Distal cephalic protuberance present. Urosome (fig. 3*f*) without ornamentation; segment 4 the shortest, segment 5 the longest. Caudal rami: Length subequal to urosome segments 3 + 4 + 5, about 7 × greatest width; with inner marginal and outer distal hairs but no surface ornamentation; caudal setae similar to those of female, lateral seta subequal to and others longer than rami.

Antennules reaching a little beyond metasome. The left differing

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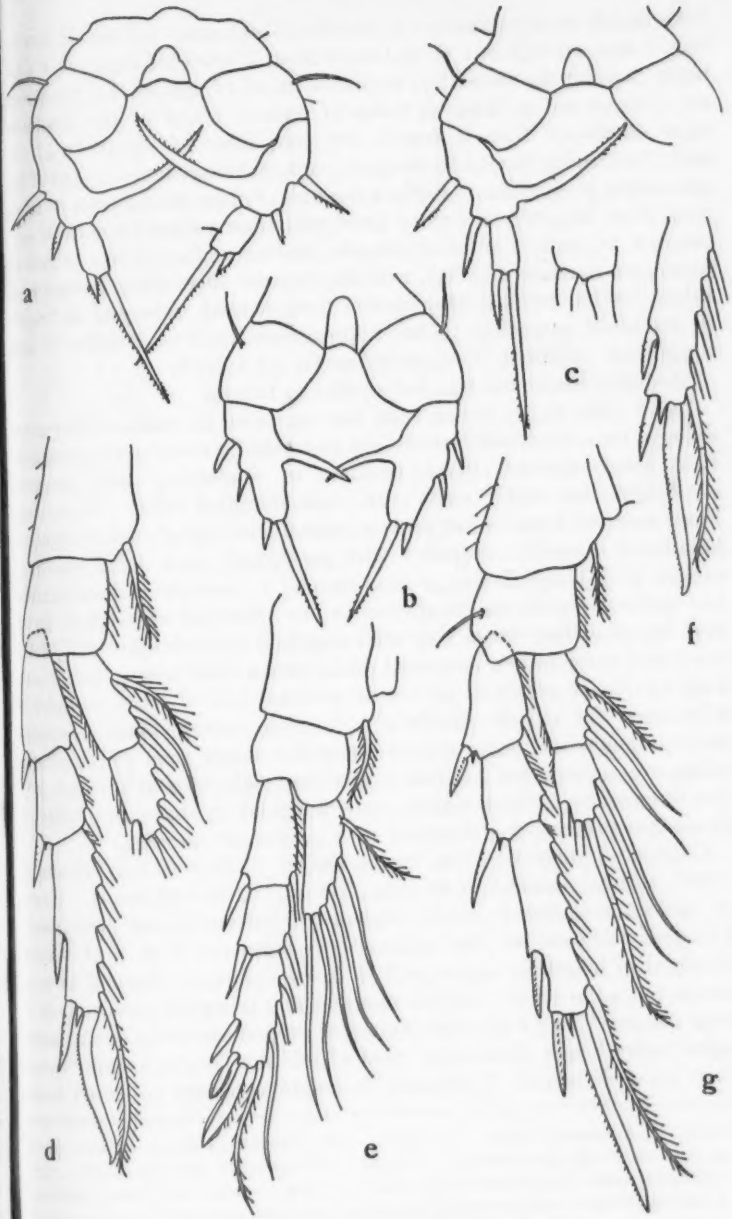
FIGURE 2.—*Eurytemora arctica*, new species, female (appendages drawn to same scale): *a* and *c*, leg 5, adult, showing variation in outer spines and detail of bases of exopod 3 spines; *b*, leg 5, copepodid stage V; *d*, leg 2; *e*, leg 1; *f*, leg 3, exopod 3; *g*, leg 4.



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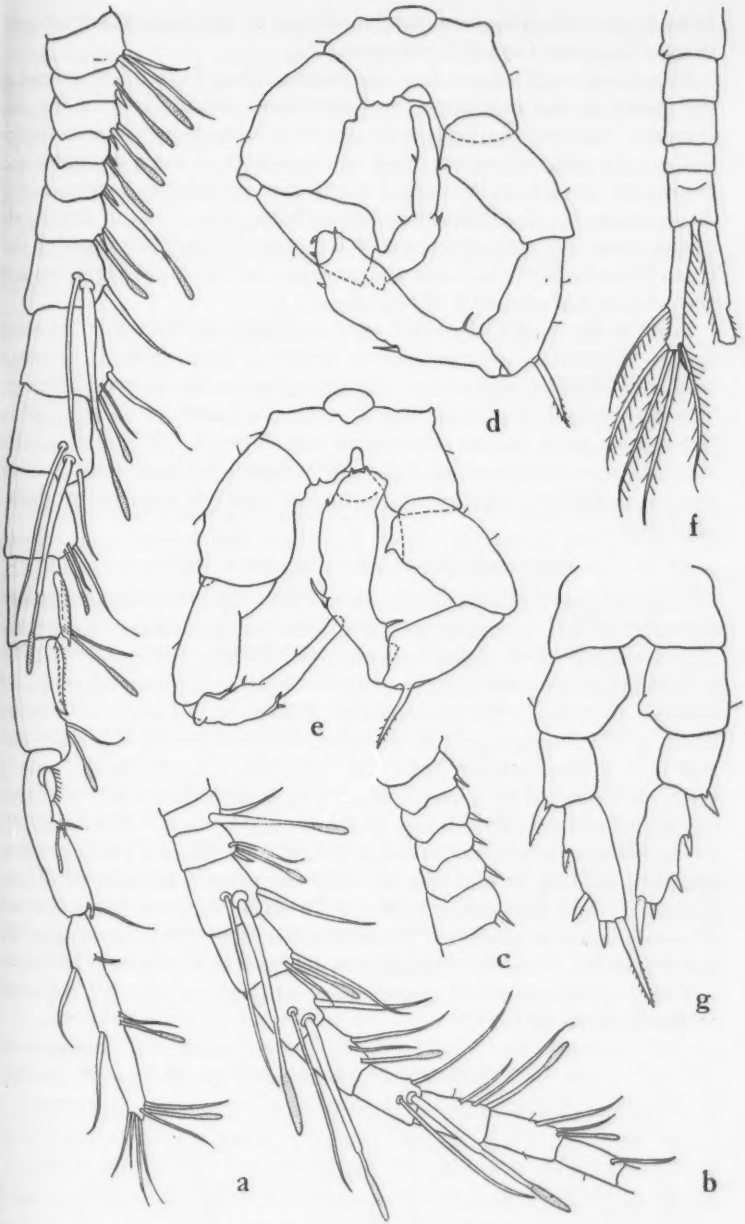
from female in more distinct separation of segments 8–9 and in having only 1 seta on segment 11 and sometimes 2 setae on segment 4 (this latter possibly an anomaly); aesthetes on all of segments 1–19 except on 4; setae not as long as those of female; many of the aesthetes more developed than in female (fig. 3*b*), those of segments 13, 15, and 17 unusually stout and elongate, each reaching almost to end of the succeeding 3 segments. Right antennule: Spines of segments 8–12 all very short (fig. 3*c*), not more developed than reduced spines of segments 8, 10, and 12 of left antennule; aesthetes of segments 13 and 15 stout and elongate (fig. 3*a*), reaching beyond succeeding 2 segments; apical portion beyond geniculation 2-segmented, subequal in length to combined segments 15–18; approximate ratio of lengths of last 4 segments (segment 17 expressed as 1): 1:1.4:2:2.6.

Mandible blade and legs 1–4 similar to female.

Leg 5 (figs. 3*d*, *e*; drawn from legs mounted in shallow depression slides so that structural features not distorted by cover glass pressure): First basal segments fused, remnant of connecting plate present; left longer than right; right with inner marginal lobes. Right leg: Basal segment 2 with small inner proximal lobe, distal part of segment broadened inwardly; exopod 1 with prominent inner distal swelling; exopod 2 only a little longer than exopod 1, constricted near middle but without segmental separation in any observed specimens, basal part broader than distal and with marginal sclerotization and short inner and outer spines, narrowed distal part a little longer than basal. Left leg: Inner proximal portion of anterior face of basal segment 2 sclerotized (or cuticle thickened), forming narrow plate produced into spinous point; outer spine of exopod 1 longer than width of segment; exopod segment 2 a little longer than right exopod 2, distal portion broadened beyond middle, apex irregular in shape but without prominent protrusion and armed with very short spinules.

Copepodid stage V: Total length range: 1.275–1.56 mm. (Lake 4, 1.38–1.46 mm.; Lake 3, 1.56 mm.; Umiat, 1.275–1.40 mm.). Form of metasome similar to adult; cephalic protuberance not prominent. Urosome 4-segmented, last segment (= segments 4 + 5 of adult) subequal in length to segments 2 + 3; caudal rami subequal to segments 3–5, as in adult. Antennules reaching to end of metasome or a little beyond. Leg 5 (fig. 3*g*): Spines of exopod segments stout; inner apical spine longer than outer, that of left side longer, usually more than one-half length of segment (a single specimen collected from

FIGURE 3.—*Eurytemora arctica*, new species, male (appendages drawn to same scale): *a*, right antennule, from segment 7 to apex; *b*, left antennule, segments 11–20; *c*, right antennule, spines of segments 8–12; *d* and *e*, leg 5, adult, anterior view (from 2 specimens in slightly different positions and undistorted by cover glass pressure); *f*, urosome, dorsal; *g*, leg 5, copepodid stage V, posterior view.



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Lake 8 had this spine less developed than in all other specimens, its length being less than half the segment).

TAXONOMY.—*E. arctica* is easily distinguished from other species of the genus by the combination of characters summarized in the definition. It does not appear to be closely related to any known species but can be assigned on the basis of characters of the antennules and female leg 5 to a broadly defined group that includes *E. composita* and *E. gracilicauda*. Leg 5 is distinctive in both sexes—that of the female in the unusually long extension of the inner process of exopod 1 and that of the male in the lobes and processes of the basal segments and the structure of exopod 2 of both legs.

Leg 5 of the male is also distinctive in copepodid stage V. No other species illustrated in literature or observed from North American fresh and brackish waters has long apical spines (as shown in fig. 3*g*). The specimens from Umiat and Noatak can therefore be assigned to this species, even though adults were not observed. It is also possible that the inner process of leg 5 of stage V female is longer than in other species of Alaskan *Eurytemora*, but more study is required to determine this.

OCCURRENCE IN CAPE THOMPSON REGION

LAKE 4 (type locality; see above, p. 554).—Only 33 individuals were captured in both quantitative and qualitative open-water and littoral samples taken on 17 dates between June 24 and November 7, 1960; no specimens occurred after September 8 nor in mid- and late winter samples in 1961. The species was present in open-water samples taken in the deepest part of the lake on 10 of the 17 dates in 1960 and in 1 littoral sample (June 24). Of the total 11 dates, only 1 specimen occurred on 4 dates, from 2 to 6 on 6 dates, and 9 adults, the largest number, were taken on the remaining date. From July 21, specimens were in copepodid stages V and VI. Stage VI (adults) first appeared on July 14 and was the only one present in samples of late August to mid-September. Of the 10 adult females, none carried ovisacs or spermatophores. Three of the 6 males taken on August 27 and September 8 had spermatophores attached to the apex of left leg 5.

Summary of number of specimens of copepodid stages (C) collected on the 11 dates of 1960:

	June	*July*					*August*			*September*	
	24	1	7	14	21	28	4	19	27	8	14
C II	1										
C III		2									
C IV♂		1	2	1							
C V♀				1	1	1	1				
C V♂				1				2			
C VI♀				2	1			2	4	1	
C VI♂				1	1				5	1	1

In 1961, collections were made in Lake 4 from April to August 7. No specimens of *E. arctica* were taken in open water until July 6. On July 13 and two subsequent dates, both open water and the beds of rooted vegetation (mostly *Arctophila fulva*) were sampled, the latter by hand-dipping a net. The samples from the two areas are not quantitatively comparable, but it is believed that due to the difficulty of maneuvering both the boat and the net in the thick vegetation, only a small part of the population of the latter was sampled.

Summary of number of specimens of copepodid stages (C) collected on four dates of 1961:

	open water			*vegetation*		
	C IV	C V♀	C V♂	C IV	C V♀	C V♂
July 6	1			not collected		
July 13		1		1	2	5
August 2			1		29	22
August 7	1	3			6	5
Total specimens			7			70

Ponds and pools near Lake 4.—The poorly drained *Carex* marsh surrounding Lake 4 has numerous ponds and pools of varying size and permanence. In 1960, *E. arctica* was collected from 3 of those having a heavy growth of vegetation around the perimeter or partially covering the water. Collection records: (1) Pond (estimated area, 500 square meters; maximum depth about 1 meter; permanent), July 7: 1 C III, 2 C V♀; occurring with *Heterocope septentrionalis* and *Diaptomus arcticus*. (2) Pool (estimated area, 83 square meters; maximum depth about 1 meter), September 8: 1 C VI♀ with ovisac, 15 C VI♂, some with spermatophores attached to apex of leg 5. (3) Pool (estimated area, 10 square meters; maximum depth about 1 meter), September 8: 2 C VI♀ (1 with incomplete ovisac), 6 C VI♂.

Lake 3 (68°11′09″ N., 165°42′02″ W.; surface area, 1.8 hectares; maximum depth, about 1.52 meters).—In 1 of 2 samples collected on different dates from open water, August 19, 1960: 2 C V♂. On July 17, 1959, 4 specimens presumed to be this species (C III, C IV) were collected by D. Hilliard from 2 separate pools in the vicinity of Lake 3.

Lake 8 (68°11′06″ N., 165°42′04″ W.; area 0.03 hectares; maximum depth about 1.52 meters).—In 1 of 2 samples collected on different dates from open water, August 19, 1960: 1 C V♂, 1 C VI♀.

In 1961, no specimens occurred in collections made on one occasion from open water and weeds of Lakes 3 and 8.

Lake 9 (68°14′06″ N., 165°34′09″ W.; about 4 miles northeast of Lake 4, in Saligvik Valley; outlet to creek tributary to Kukpuk River; surface area about 12 hectares; maximum depth unknown but prob-

ably not over 3 meters).—The single collection from this lake, August 21, 1960, contained 7 adults: 6 ♀ (5 with ovisacs), 1 ♂.

PONDS AND POOLS NEAR LAKE 9.—(1) Pool (about 1 mile northwest; estimated area, 25 square meters; maximum depth about 1 meter; vegetation largely *Carex* and *Sphagnum*), August 23, 1960: 1 C VI ♀, 1 C VI ♂. (2) Pond (about 1 mile southwest; estimated area, 627 square meters; maximum depth about 1.5 meters; vegetation largely *Hipperus*, *Arctophila*, *Sphagnum*), August 21, 1960: 1 C V ♀.

COASTAL REGION SOUTH OF CAPE THOMPSON.—One or two specimens were collected from each of four more or less brackish pools near Singoalik Lagoon in 1960 (table 1). Large numbers of *E. gracilicauda* of similar size and habitus (see p. 567), occurred in two of these samples and early copepodid stages (C II–C III) that were present might be either of the two species. In 1961, recognizable stages of *E. arctica* were not collected in any coastal pools that were sampled.

OCCURRENCE IN NOATAK RIVER WATERSHED

Locality about 58 miles inland from Chukchi Sea, near junction of Kelly and Noatak Rivers, about 67°58′ N., 162°20′ W. Tash collection: 12 C V ♀♂; permanent freshwater pond, area about 0.2 hectares, depth about 1.8 meters, from weedy margin (*Carex* dominant), July 29, 1961; occurring with *Diaptomus gracilis*. This region is a part of the Brooks Range physiographic province southeast of Cape Thompson; the Noatak River and its tributaries drain a considerable part of the western portion of the northern mountains of Alaska. *Eurytemora yukonensis*, not yet known from the Arctic Slope province, also occurred in shallow bodies of water of the Noatak region with *D. gracilis*.

OCCURRENCE AT UMIAT

Locality on Colville River in northern Alaska, in foothills of Brooks Range, about 65 miles inland from Beaufort Sea, about 69°24′ N., 152°15′ W. Wilson collection: 41 specimens (9 C IV ♀♂; 32 C V ♀♂) taken by casting small net an unknown distance from shore in shallow, freshwater permanent pond, estimated area about 0.2 hectares, July 29, 1949, collector, C. S. Wilson; occurring with a few specimens of *Heterocope septentrionalis* (C VI) and *Diaptomus pribilofensis* (C IV–VI).

BIONOMICS

Restriction to either brackish or fresh water cannot be assumed for species of *Eurytemora*, but some occur much more commonly in one than in the other. *E. arctica* was rare in brackish coastal pools and was not found in the lagoons at Cape Thompson, although all other

Arctic Slope species that range from brackish into fresh water were collected in them. As presently known the species occurs commonly in small, shallow freshwater tundra lakes, pools, and ponds, and rarely in coastal brackish pools. Its distributional range is in the Arctic Slope and Brooks Range physiographic provinces, from the coastal region of Cape Thompson east to Umiat and south to the Noatak River watershed, between about 67°–70° N. latitude and 152°–166° W. longitude.

The species of *Eurytemora* found in fresh water occur in a variety of bodies of water, ranging in size from shallow pools to large, deep lakes. Although some species appear environmentally restricted, others seem ubiquitous, and it is difficult to judge from distributional data what habitats are marginal for such species. For instance, in Alaska *E. yukonensis* occurs in the largest and deepest lakes of the State (those of the Bristol Bay region) but is also found in shallow lakes and ponds along the lower Yukon and Noatak Rivers, where it has been collected from both open waters and submerged vegetation. Other species of *Eurytemora* have been found abundantly in the rooted vegetation of small, shallow lakes and ponds; for example, *E. gracilicauda* was collected in large numbers from grassy margins and from beds of *Arctophila* of small, shallow lakes and ponds on eastern Saint Matthew Island in the Bering Sea, about 60°30′ N., 173°30′ W. (Wilson collection: August 1954, R. and R. Rausch, collectors; a few *Diaptomus pribilofensis* occurred in some of the weed collections). There are records in the literature of other species of *Eurytemora* associated with weeds. Willey (1923a, p. 331; 1923b, p. 6) records a reproducing population of *E. affinis* "amongst dwarf weeds in the littoral zone of a swampy shore" of Lake St. John, Quebec, and Lowndes (1935) reports *E. velox* as not only common among weeds but as being found "attached to algae." From these observations it appears that studies of freshwater calanoid copepods in geographic regions in which *Eurytemora* is expected to occur must include exploration of more than the open waters of lakes and ponds, usually considered as the typical habitat for calanoids.

Eurytemora arctica in the Cape Thompson region represents an example of this need for detailed examination of weed beds. In the open waters of Lake 4 (depth, 2.4 meters) large numbers of three other calanoid copepods (*Heterocope septentrionalis*, *Diaptomus arcticus* and *D. pribilofensis*) were collected throughout the season in 1960 in noticeable contrast to the small numbers of *E. arctica*. This erratic occurrence of *E. arctica* in open-water samples suggested a population localized within the lake and from which occasional individuals wandered into the selected areas being routinely sampled. Therefore, in 1961, other areas of the lake were investigated and larger numbers

of *E. arctica* were captured from the thick beds of *Arctophila* that extend out into the lake (water depth, 1.0–1.5 meters) than in open water (see above, p. 563)—in contrast to relatively few individuals of the other calanoid copepods. Although the data are not as exhaustive as is desirable, we believe it reasonable to assume that the population of this lake is localized in the *Arctophila* beds. In the Noatak River pond, the species was likewise collected among weeds but not from open water. Other records of occurrence contribute little to the question of localization in weed beds. The vegetation of the pond at Umiat, from which fairly large numbers were taken, is unknown, but the method of collecting precluded sampling of both the deepest open water and thick weed beds, while not excluding thinly developed littoral growths. Excepting Lake 4, none of the bodies of water in the Cape Thompson region were sampled adequately or frequently enough to determine the absence or the preferences of a highly localized or rare species.

It is reasonable to suggest from the available data that the population of *E. arctica* in Lake 4 is monocyclic and overwinters as resting eggs, rather than as adults or late copepodid stages, as is probably true for many other calanoid copepods in shallow bodies of fresh water on the Arctic Slope of Alaska (Wilson and Tash, MS.). Data are not conclusive because the localized habitat was not adequately sampled for a critical study of the life cycle, and the suggestion originates from these observations: (1) littoral and open-water samples of late spring-early summer in 1960 and 1961, during and after thawing, had neither adults nor late copepodid stages; (2) copepodid stages found in 1960 showed seasonal progression from early to adult stage, and developmental stages were not collected after adults had become established; (3) samples from the deep, open waters taken under ice in January 1961 (ice depth, 1.22 meters) and in April when ice depth was greatest (1.75 meters) contained no *Eurytemora* of any stage.

The weedy portion of the lake in which the population is presumably established is of such depth (1.0–1.5 meters) that it freezes to the bottom by the end of winter (April) so that copepodid stages would not survive during the winter. It should be noted also that no specimens were collected in open water after September 14, 1960, although other calanoids were present in samples taken until November 7. Presumably, reproduction takes place in the *Arctophila* bed, and overwintering resting eggs would be deposited there. The only indications of dates of breeding and egg production were late in the season (August 21, 27, and September 8) when males with spermatophores on leg 5 and females with ovisacs were taken in Lake 4 and nearby pools, and in Lake 9.

Field studies on coastal pool populations were too few to supply

evidence for the bionomics of *E. arctica*, and only some speculative points that might have value in future studies can be offered. Presumably development in some pools is both earlier and more rapid than in other pools and in Lake 4. The appearance of adults of *E. arctica* in one pool and of *E. gracilicauda* in two pools as early as June 29, 1960, cannot be accounted for by overwintering of live specimens, because the pools are so shallow they would freeze to the bottom before thawing. It is more reasonable to assume that the populations of these two species developed from overwintering resting eggs in bodies of water that not only melted early (as was observed in the coastal area for some bodies of water in May) but had a high enough temperature to permit a comparatively rapid development of some of the population to the adult stage. If such bodies of water did not dry out during the summer season there would be time for development of a second generation as Oloffson (1918) postulated for *E. raboti* in Spitzbergen and as may be true for some Alaskan *Eurytemora*. On the other hand, adults of a monocyclic population that developed rapidly might not persist long after egg production in a shallow pool with fluctuating water level where it is associated with a related and more dominant species. Successful collection of a short-lived, monocyclic species would be dependent upon an element of chance in sampling the body of water at the particular short period of time when identifiable copepodid stages were present. Such factors might account in part for failure to collect more specimens of *E. arctica* in the coastal pools. An additional factor that might be very important but difficult to assess until more of the numerous bodies of water along the coast of Alaska are investigated, is that brackish water even of very low salinity is a marginal habitat for *E. arctica*, it being dominantly a freshwater species.

Coastal Pools and Ponds

Three species of *Eurytemora* were collected in pools and ponds on the coast (table 1). Of these, precisely identifiable copepodid stages of *E. arctica* occurred only as one or two specimens in four pools in 1960, so that its importance as part of the coastal brackish fauna is not known. The other two species, *E. canadensis* and *E. gracilicauda*, occurred in large numbers and frequently enough to be considered characteristic elements of both fresh and brackish coastal bodies of water. They were associated with one another in brackish pools or occasionally with *Limnocalanus johanseni*, a dominant associate of *Eurytemora* in nearby lagoons and the only other calanoid copepod found in the brackish pools. In freshwater pools, *E. gracilicauda* occurred with the freshwater calanoid *Heterocope septentrionalis*.

Samples reported here represent only a small part of such habitats in the entire Cape Thompson region. Most are from the marshy area near Singoalik Lagoon and are characterized as pools because of their intermittent nature and small size. Many are shallow, ranging from only 15 to 30 cm. in depth but some have a maximum depth of about 1 meter. Those near Singoalik and Mapsorak Lagoons are considered as more or less brackish; precise salinity records associated with the collections are not available but other records indicate that they are not continuously fresh. Salinity undoubtedly varies with the fluctuating water level which may be considerable both during a season and from one year to another.

Records are summarized by year of collection in table 1. Excepting Pool 1, the pools from which collections were made in 1961 were not correlated with any of the previous year, and it is not known which correspond to the pools listed for 1960. Copepodid stages are listed for each date. In no instance do the collections furnish adequate data for life cycle studies, but they do emphasize the value of the locale for such studies. Of particular interest is the question of whether such populations of *Eurytemora*, unlike most other calanoids of continental bodies of water on the Arctic Slope, produce more than one generation a year (Wilson and Tash, MS.). The copepodid stages present in the series of 1960 collections in Pool 1 (table 1) suggest two generations of *E. gracilicauda*. Absence of any specimens in the middle of the season may have been due to the presence of the species only as naupliar stages which collecting gear failed to sample. Production of two generations in a season would undoubtedly be dependent upon early melting of snow and ice in the region, as probably happened in 1960 when adults bearing ovisacs were collected as early as June 29 (see discussion under *E. arctica*, p. 567). As with *E. gracilicauda*, the records of *E. canadensis* in shallow pools that freeze to the bottom, not only in the Cape Thompson region but in other parts of its distributional range, suggest overwintering of the species as resting eggs.

Coastal Lagoons

Including those studied by Johnson in 1959, a total of 11 lagoons has been surveyed. As Johnson (1961) indicated, they group naturally into those lying north and south of Cape Thompson, and they are summarized here by these geographic subdivisions (table 2). They are dish shaped in profile, range in length from 3.2 to 8.0 km., are shallow (maximum depth, 3 meters), and are free of ice cover for about 2½–3 months. Most do not now have direct connections with the sea. Maximum temperatures recorded in 1960 were 13.7° C. on July 18 for Mapsorak Lagoon and 16.2° C. for Pusigrak Lagoon.

TABLE 1.—*Calanoid copepod species composition (genera* Eurytemora *and* Limnocalanus*) of Cape Thompson coastal pools and ponds, 1960–1961*

Body of water	Location (see table 2 for location of lagoons)	Brackish water	Fresh water	Date	Copepodid stages (I–VI)				
					E. arctica	*E. gracilicauda*	*E.* imms.†	*E. canadensis*	*L. johansenii*
				1960					
pool	near Akoviknak Lagoon		X	July 13				IV–VI	
pool	E. end Mapsorak Lagoon	X		July 26				IV	
pothole	dry creekbed near Mapsorak Lagoon	?		July 26				*I–VI	
Pool 1	near Singoalik Lagoon	X		June 29		*IV–VI	III		
				July 4		*V–VI		*V–VI	
				July 11		V–VI	I–II	*VI	
				July 18	V (1 ♂)	*IV–VI	I–III		
				July 25		*VI	III		
				Aug. 1, 8					
				Aug. 17			I–II		
				Aug. 22		VI			
				Aug. 29		V–VI		II–V	
pool	near Singoalik Lagoon	X		June 29	VI (1 ♀)	IV–VI			
				July 12		IV–V			V–VI
3 pools	near Singoalik Lagoon	X		July 12		*IV–VI	III	*IV–VI	
pool	near Singoalik Lagoon	X		Aug. 23		IV–V	II–III		VI (1♀)
2 pools	near Singoalik Lagoon	X		Aug. 23		*IV–VI	II–III		
pond	near Singoalik Lagoon	X		July 12				V–VI	VI
2 pools	near above pond	X		Aug. 29	VI (2♀, 1♂)				
pool	E. bank Singoalik Creek, 1 mi. N. Singoalik Lagoon		X	Aug. 6		IV–VI			
pool	near above		X	Aug. 6		VI	with *Heterocope septentrionalis*		
pool	near Singoalik Creek, 2 mi. inland		X	Aug. 6		*IV–VI			
pool	E. bank Ogotoruk Creek, 1 mi. N. Chariot site		X	July 28				V	
				1961					
Pool 1	near Singoalik Lagoon	X		July 10		*IV–VI	II–III		
pool	near Singoalik Lagoon	X		July 10		IV–VI		IV–V	
pool	near Singoalik Lagoon	X		July 10		*VI		*III–VI	VI
pool	near Singoalik Lagoon	X		July 10				II–V	
pool	near Singoalik Lagoon	X		July 10		IV–V	I–III	III–V	
pool	at Chariot site (68°09′ N., 165° 45′ W.)		X	July 16		IV–VI	with *Heterocope septentrionalis*		

*Females with attached ovisacs present in sample.

†Stages I–III of *E. arctica* and *E. gracilicauda* cannot be distinguished from one another with precision; probably most, if not all, specimens listed in this column are *E. gracilicauda*; none are *E. canadensis*.

With a few exceptions during the observed periods, salinity was relatively low (table 2). It seems logical to expect, however, that the salinity of all the lagoons may be subject to greater or lesser variation both throughout the season and from one year to another because of physical factors influenced by the weather and climate of this high latitude region. Strong winds are frequent even in the summer months, resulting in practically no thermal or haline stratification and contributing also to an erratic sampling of plankton organisms. Thus, data from one week or year to another are not necessarily sufficient to estimate accurately the quantitative abundance of a species or to assume that its absence from a sample means that it was also absent from the lagoon. Records in table 2 should be viewed on the basis of these considerations.

Johnson found four species of *Eurytemora* in nine of the lagoons in 1959. Two of these (*E. herdmani*, *E. pacifica*) were not found in our collections, but three additional species (*E. composita*, *E. raboti*, *E. gracilicauda*) occurred. *E. arctica* was not present in the lagoons but was collected in pools, so that eight species of *Eurytemora* occur in the coastal area. In order to indicate what is known of the continuity of species composition shown by three years of collecting, Johnson's records for August 1959 are combined here with our records of July 1959 and of 1960–1961 (table 2).

With two exceptions, collections from the eight lagoons south of Cape Thompson yielded only *E. canadensis*, usually in association with and in smaller numbers than *Limnocalanus johanseni*. Both of these species in Alaska occur along the coast in waters ranging from low salinity to fresh, but there are more known records of *E. canadensis* than of *L. johanseni* in fresh water with associated freshwater calanoid genera such as *Heterocope* and *Diaptomus* (literature and Wilson collection).

Mapsorak Lagoon (Johnson no. 2S) presents a striking example of the temporal nature of the copepod communities that may at times be collected. In 1959, Johnson found nine marine species that he considered as having been "probably only recently recruited from the sea." He describes the lagoon as having "a narrow above-sea-outlet that probably floods with sea water during high storms." That this large assemblage of species probably had been washed into the lagoon from the sea is suggested by the high salinity and by the fact that none of the species was found in series of samples taken weekly in 1960 and 1961. The difference in the species of *Eurytemora* found in the three years is noteworthy. *E. herdmani* and *E. pacifica*, occurring only during the period of high salinity in 1959, are typical of inshore waters of the Alaskan coast but are not known from fresh waters nor from waters of extremely low salinity. In 1960, relatively low salinity

was recorded and four other species of *Eurytemora* were found (table 2), all of which range from brackish to fresh waters. Of these, *E. composita* and *E. raboti* were not collected again in Cape Thompson samples, but since they are known to be widely distributed in diverse bodies of water along the northwestern Alaskan coast, they may well occur in unsampled ponds or pools of the area. Whether populations are established in inshore-offshore waters is unknown but both have been recorded from coastal continental bodies of water of high salinity (Mohr et al, 1961; Holmquist, 1963; Heron, 1964). Since ovigerous females and developmental stages of both species were found in the lagoon in 1960 on several dates, it was surprising not to find them in 1961 samples. The other two species of 1960 samples, *E. canadensis* and *E. gracilicauda*, are both highly characteristic of waters of very low salinity and commonly range into fresh waters. *E. gracilicauda* occurred in very small numbers on only two different dates in 1960, and its absence in 1961 suggests it may have been a straggler washed into the lagoon from nearby pools.

The sparsity of numbers of individuals of species such as *E. canadensis*, and the lack of knowledge of occurrence of other species throughout the season, did not make the collections of value for life cycle studies. However, observations of the populations of *E. foveola* from the lagoons north of Cape Thompson indicated that they were reproducing. Collections in July contained ovigerous females with developing ova, accompanied by all copepodid stages, suggesting the possibility that this species could produce two generations during favorable seasons. Aiautak Lagoon is very large (about 8 km. in length), and the single collection, a littoral tow from the south end, may give an incomplete indication of its calanoid species composition. *E. foveola* has not yet been found in fresh water (Wilson collection), but its occurrence in lagoons of low, variable salinity and association with other species of *Eurytemora* that are known to range from brackish to fresh waters, suggest a greater euryhalinity than indicated by the presently known occurrences.

Crustaceans other than calanoid copepods were at times abundant in the lagoons, especially *Cyclops* spp. and *Daphnia* spp. (Johnson, 1961; Hilliard and Tash, 1966). Both of these freshwater genera are recorded throughout literature from brackish waters along seacoasts (examples can be found in Gurney, 1933; C. B. Wilson, 1932; Lagerspetz, 1958; Carpelan, 1964). Some species are tolerant of low salinities and of changing conditions throughout the season. The almost universal tendency to consider them as genera confined to fresh water may be misleading when attempting to characterize coastal bodies of water by their faunal elements. In some regions, the absence of freshwater calanoid genera is probably more significant

TABLE 2.—*Calanoid copepod species composition of Cape Thompson lagoons, 1959–1961, based on data for August 1959 from Johnson (1961), collections by D. Hilliard in July 1959 and J. C. Tash in 1960 and 1961* (+ = less than 10 specimens, usually 1–5; + + = 10 or more specimens)

Lagoon	Location Lat. N.	Long. W.	Date collected [1]	Salinity °/₀₀ [2]	*Eurytemora* [3] *ca*	*co*	*f*	*g*	*h*	*p*	*r*	*Limnocalanus* [3] *g*	*j*	*Acartia* [3] spp.	Other [3] spp.
Aiautak	68°13′	166°08′	July 20, 1959	0.28–0.85			++	+							
Kemegrak	68°14′	166°06′	July 20, 1959	0.3			++						++		
			Aug. 5, 15, 1959	0.46–0.55			++						++		
			July 13, 1960	0.15			++						+		
Akoviknak	68°12′	166°02′	Aug. 14, 1959	0.18–0.18			++					++	++		
			July 12, 23, 1960	0.07			++								
Atosik	68°03′	165°26′	Aug. 6, 12, 1959	0.83–0.83	+								++		
Mapsorak	68°02′	165°21′	Aug. 6, 12, 1959	14.31–15.96					++	+				++	++
			July 4–Sept. 5, 1960	0.85–0.87	++	++		+			++		++		
			June 3–Aug. 5, 1961	0.4 (June 3)	++								++		
Pusigrak	68°01′	165°18′	July 29, 1959	0.093	+								+		
				0.16–0.17	+								++		

[1] 1959 = Johnson (1961); 1960 = Tash; 1961 = Tash.
[2] Salinity: Johnson (1961) = surface; Tash = bottom.
[3] Species: *ca* = *calanus*; *co* = *columbiae*; *f* = *fluviatilis*; *g* = *glacialis*; *h* = *herdmani*; *p* = *pacifica*; *r* = *rostrifrons*; *g* = *gracilis*; *j* = *jashnovi*.

+—1mm.

| | | |

in determining brackishness in absence of other data. In the Cape Thompson lagoons of very low salinity, the common freshwater calanoid genera of the region, *Heterocope* and *Diaptomus*, have not established populations. A few specimens of *D. arcticus* were found in one lagoon in August 1960, but since none were collected at other dates, we believe them to be stragglers washed into the lagoon from a freshwater source. The few harpacticoid copepod genera that were collected are, like the calanoid genera *Eurytemora* and *Limnocalanus*, those having species with varying degrees of euryhalinity—*Danielssenia*, *Nitocra*, *Onychocamptus*.

Distribution of Cape Thompson *Eurytemora*

The group of eight species of *Eurytemora* in the relatively small area surveyed on the coast of the Chukchi Sea, ranging 39 miles north and south of Cape Thompson (from latitude 68°15′–67°55′ N. and longitude 165°02′–166°08′ W.) and about 11 miles inland (from latitude 68°11′–68°14′ N.) is the largest assemblage of species of the genus recorded from any similar-sized area of the world. This group also represents about one-half of the species known for the world and nearly all of those known for Alaska (8:10) or North America (8:11). Similar large numbers of species occur in coastal areas south of Cape Thompson, where Heron (1964) found, in a single sample, five species in Kivalina Lagoon and four species in two samples from Krusenstern Lagoon. Including those of neritic waters and continental bodies of water, five species are currently known (literature and Wilson collection) along the Beaufort seacoast from Point Barrow eastwards as well as along the coast of the Bering Sea south to the Alaska Peninsula. Similar numbers occur in nearby Asian waters so that the geographic region of northern and western Alaska and northeastern Asia is, in present-day distribution, richer in numbers of species than any other of the world. This large representation probably reflects the northern origin of both the genus and many of its species, and emphasizes how well the biological requirements of the species are met by the arctic-subarctic environment. The species of all types of habitat illustrate the strong zoogeographic affinity between the copepod faunas of Alaska and northeastern Asia, previously pointed out by M. S. Wilson (1953b).

The eight species of Cape Thompson *Eurytemora* include all but one of the total number known for landlocked bodies of water of the Arctic Slope physiographic province of Alaska, of which the Cape Thompson region is a part. In this province, comprising the Arctic coastal plain and the foothills of the Brooks Mountain Range,

including the Chukchi seacoast south to about Cape Krusenstern, *Eurytemora* is known from scattered localities along the Beaufort and Chukchi seacoasts to about 65 miles inland. The nine Arctic Slope species include those of inshore-offshore waters (*E. americana, herdmani, pacifica*) which have been found at least once in a body of water on land. The species composition of the two large lagoons south of Cape Thompson at Kivalina and Cape Krusenstern, studied by Heron (1964), is similar to that of some lagoons at Cape Thompson except that *E. americana* was present and *E. canadensis* was absent from Heron's samples. Further exploration of fresh waters may add to the Arctic Slope list the tenth species known from Alaska, *E. yukonensis* M. S. Wilson (1953a). The northernmost record of this species is just southeast of Cape Thompson in the Noatak River watershed (above, p. 564).

Four Cape Thompson species are recent additions to North American fauna. In addition to *E. arctica* described above, *E foveola* was described from Cape Thompson lagoons by Johnson (1961). *E. raboti* ranges from Spitzbergen and the Siberian coast to the Barrow region, Alaska, where it has been found in collections of J. L. Mohr and associates, made in 1953 in brackish ponds (Wilson collection) and in 1960 in Nuwuk Lake (Mohr et al, 1961). It was collected in 1961 from Sinclair (or Minga) Lake, east of Barrow, by Holmquist (1963). It was first recognized in North American waters by Heron (1964) in 1959 samples from Krusenstern and Kivalina Lagoons. *E. gracilicauda*, another Asian species new to North America, was described by Akatova (1949) from freshwater Siberian lakes in the basin of the Kolyma River (about 69° N., 161° E.). The Wilson collection has several samples of *E. gracilicauda* from Alaskan fresh and brackish waters, ranging from the Arctic Slope south to the Alaska Peninsula; figures and notes are in manuscript to be published elsewhere.

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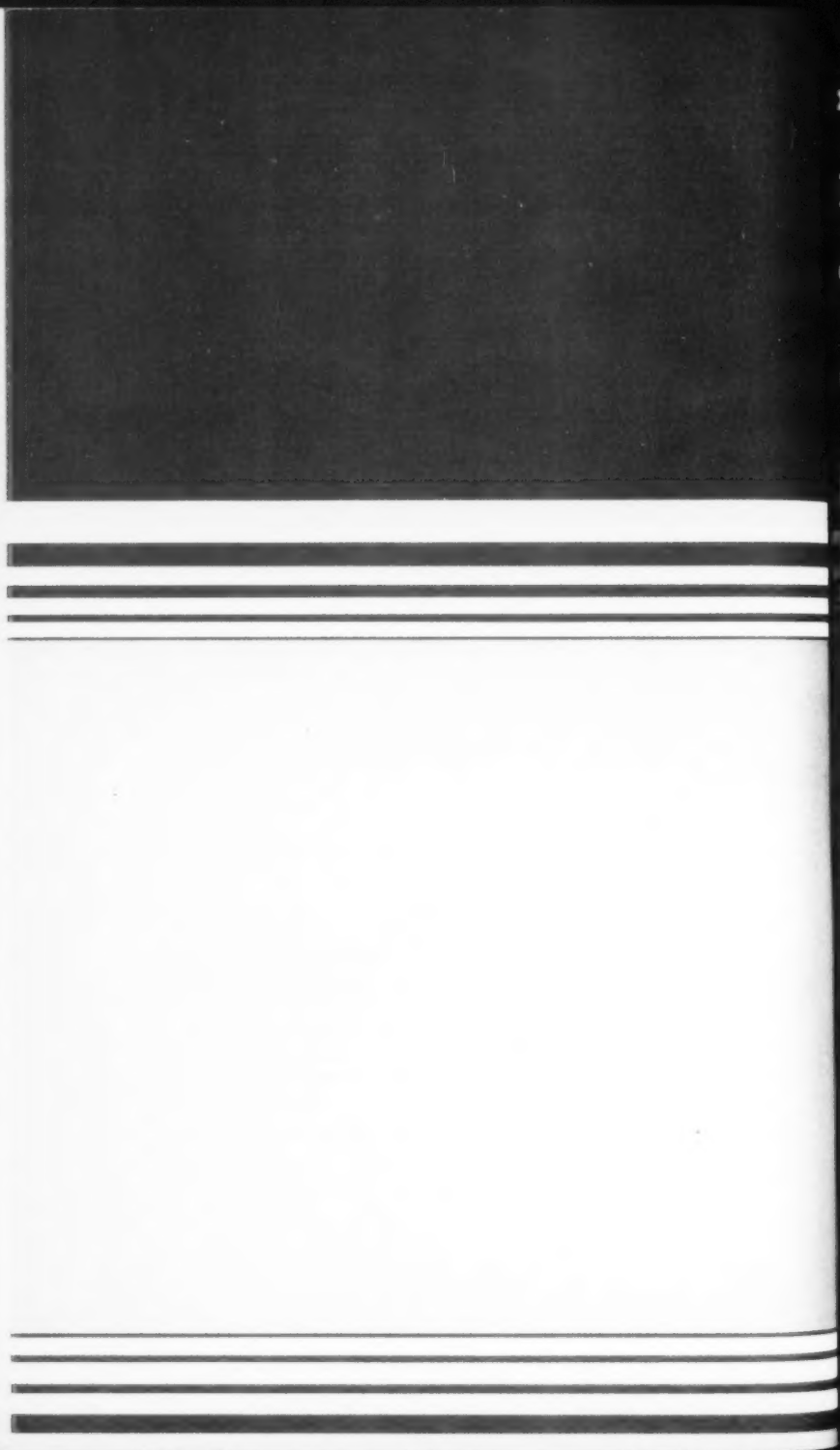

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NEOTROPICAL MICROLEPIDOPTERA, IX

REVISION OF GENUS PSEUDATTERIA (LEPIDOPTERA: TORTRICIDAE)

By NICHOLAS S. OBRAZTSOV

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REVISION OF GENUS PSEUDATTERIA (LEPIDOPTERA: TORTRICIDAE) [1]

BY NICHOLAS S. OBRAZTSOV [2]

The species of the genus *Pseudatteria* Walsingham with their comparatively large size and bright coloring appear as the most striking moths among the entire South American Tortricidae; together with two other superficially similar genera, *Atteria* Walker and *Idolatteria* Walsingham, they represent an endemic group of the Neotropical fauna. Meyrick (1908) established a separate family Ceracidae which included the Oriental and Palaearctic genus *Cerace* Walker. Misled by some superficial resemblance of the Neotropical *Atteria* with *Cerace*, the same author (Meyrick, 1910) considered them to be synonyms of a common genus. In accordance with this the *Pseudatteria* species, not separated at that time from *Atteria*, should also become members of the family Ceracidae. Later Meyrick (1912) included this "family" in the Tortricidae, and treated it (Meyrick, 1913) as a group of genera, not naming it separately.

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Busck (1932) probably overlooked the publication of the name Ceracidae by Meyrick and established for the same group a synonymic family name Atteriidae. Clarke (1955) was the first who turned his attention to the male genitalia of *Pseudatteria* and stressed the close relationship of this genus to the genera *Polyortha* Dognin and *Ardeutica* Meyrick. Studies of the present author have confirmed this relationship in the morphology of the female genitalia also. Moreover, these studies have shown that the genera *Atteria* and *Idolatteria* have nothing in common with Pseudatteria except for the superficial resemblance; *Atteria* should be placed in Anacrusini (new status) and *Idolatteria* in the tribe Archipini. The genera *Pseudatteria*, *Polyortha*, and *Ardeutica* require separation as the new tribe Polyorthini, established in this paper. All of the above-mentioned genera are quite distinct from the tribe Ceracini which maintains its recognized status (Obraztsov, 1954.)

This paper represents the first revision of the genus *Pseudatteria*. Until the present, most of the species have been known from the original descriptions only; additional information was published by Clarke (1958) for the species established by Meyrick. Favorable circumstances have given the present author an opportunity to examine the type specimens of all known species, to figure them and their genitalia, to establish the synonymy, to study extensive comparative materials, and to describe seven new species and one new subspecies. The paper deals with 24 species of the genus *Pseudatteria;* some species are represented by females only.

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Polyorthini, new tribe

Tineidae (in part).—Dognin, 1912, Hétérocères nouveaux de l'Amerique du Sud, fasc. 6, p. 50.

Tortricidae, groups B (in part) and D (in part) Meyrick, 1913, *in* Wytsman, Genera insectorum, fasc. 149, pp. 20 and 47.

Atteriidae (in part) Busck, 1932, Bol. Biol., vol. 21, p. 44.

Ceracidii (in part).—Diakonoff, 1939, Zool. Meded. Rijksmus. Nat. Hist., vol. 21, p. 128.

Head with face more or less smooth. Antenna simple or false serrate because of slightly raised scales; in male shortly pubescent with setae protruding, cilia not longer than width of antennal shaft, in female with setae only. Labial palpus porrect, moderate to very long, tapering distad, rarely with second segment dilated by scales. Vein R_5 of forewing to costa or apex; no costal fold in male.

MALE GENITALIA.—Eighth abdominal segment with large, well-developed coremata, one on each side of segment; clusters of long hair arising from these coremata, in resting position hidden in folds of valvae. Uncus moderate to rather long, variously shaped, often with an apical thorn directed ventrad and at base generally accompanied by a soft papilla; socius moderate to large, hairy, generally padlike with broad base, pendant, occasionally modified; gnathos with lateral arms distally fused into a middle process. Valva very broad, folded outward along sacculus, crossing it longitudinally at about middle, and thus forming a kind of pocket opened costally and externally; sacculus slightly sclerotized at base, then occasionally prolonged as a narrow strip along edge of fold of valva; costa sometimes sclerotized, occasionally with a rudimentary harpe; no pulvinus and processus basalis. Fultura superior shaped as a transverse bar between upper inner angles of valvae; vallum penis generally with a lamina praeputialis. Aedeagus generally thick, robust, occasionally slender, mostly with an apical process, often with sculptures in apical portion; cornutus as a rule single, large, corniform or variously platelet shaped; rarely more than one cornutus or no cornuti; cuneus of little spines or thorns often present.

FEMALE GENITALIA.—Papillae anales broad, pelmiform, hairy; eighth abdominal segment rather short; ovipositor, if developed, formed by three narrow, subcylindrical, retractable segments, and ending with minute papillae anales. Sinus vaginalis wide, more or less infundibular, deep or rather flat, located caudad of seventh abdominal segment, and as broad as latter; sterigma simple, composed of a rather narrow, band-shaped, transverse lamella antevaginalis

occasionally fused with adjoining intersegmental membrane showing in this case a somewhat modified structure; lamella postvaginalis generally not defined, membranous, forming dorsal wall of sinusal funnel. Antrum tubular, generally sclerotized, always rather short and wide, as a rule with two lateral colliculi, one on each side of antrum. Corpus bursae generally elongate, much longer than broad, occasionally somewhat ovate, in greatest portion membranous with very fine sculpture; cervix bursae as a rule not separated from corpus bursae, merely definable morphologically, more or less sclerotized and sculptured, as broad as or broader than antrum, occasionally fused with it; ductus seminalis opening into caudal portion of cervix bursae, close to antrum; cestum elongate, more or less sclerotized, often with a longitudinal carina, located or starting in cervical area of bursa copulatrix, rarely cephalad of it or missing; signum generally present, shaped as slightly sclerotized, small area or plate, not always distinctly separated from adjacent surface of corpus bursae, generally with a transverse, slightly elevated carina and/or various sculptures.

Remarks.—The valva of the Polyorthini is very peculiar and unique for the entire family Tortricidae. If spread, it is extraordinarily broad, but normally it is folded along the sacculus, and the broad infrasaccular lobe, unbent externally, forms together with the inner lobe of the valva a kind of pocket opened externally and costally. This pocket serves as a receptacle for the cluster of long hairs of the corema. The folded valva is foliaceus in its shape. Morphologically the external lobe of the valva is probably the same as the infrasaccular portion of the valva of some species of Archipini and Anacrusiini, in which it is rudimentary and not straight.

The female genitalia of the Polyorthini are characterized by a wide ostium bursae, and a low differentiation of the separate sections of the bursa copulatrix. In most species of the tribe, merely the antrum is separated from the bursa while the cervix bursae is united with the corpus bursae. Only some few species have the caudal portion of the cervical section narrower than the remaining corpus bursae. The ductus seminalis opens into this narrow portion, but in the species without this contraction the cervical section of the corpus bursae directly receives the ductus seminalis. In connection with this morphology, there are reasons to indicate the caudal sclerotized sculpture of the wall of the corpus bursae as a cestum, leaving the name of the signum for the sculpture located closer to the fundus bursae.

In regard to the genitalia, the tribe Polyorthini is rather close to the Cnephasiini. The position of vein R_5 of the forewing, running in the Polyorthini to the costa or the wing apex, speaks rather for a more ancient origin of this tribe and its probable relationship to the Tor-

tricini. The tribe includes the genera *Polyortha* Dognin, *Ardeutica* Meyrick, *Pseudatteria* Walsingham, and others not yet described and presently in *Polyortha*. Thus, a key to the genera of the Polyorthini cannot be given until a revision of the genus *Polyortha* is completed.

Genus *Pseudatteria* Walsingham, 1913

FIGURES 1–12

Atteria (in part).—Butler, 1872, Cistula Ent., vol. 1, pp. 89–90.—Felder, 1872, Heterocera, *in* Reise der östereichischen Fregatte Novara, Zool. Theil, vol. 2, zweite Abth., p. 3.—Butler, 1874, Lepidoptera Exotica, p. 178.—Druce, 1901, Ann. Mag. Nat. Hist., ser. 7, vol. 7, pp. 439–440.—Dognin, 1904, Ann. Soc. Ent. Belgique, vol. 48, pp. 132–133.—Meyrick, 1909, Trans. Ent. Soc. London, p. 14.—Dognin, 1912, Hétérocères nouveaux de l'Amérique du Sud, fasc. 6, p. 51.—Meyrick, 1912, Trans. Ent. Soc. London, 1911, p. 676.

Pseudatteria Meyrick, 1912, *in* Wagner, Lepidopterorum catalogus, pt. 10, p. 16 [quotation of an unpublished name]; 1913, *in* Wytsman, Genera insectorum, fasc. 149, p. 22. [Type species: *Atteria volcanica* Butler, 1872.]

Pseudatteria Walsingham, 1913, Biologia Centrali-Americana, Lepidoptera Heterocera, vol. 4, p. 214; 1914, op. cit., vol. 4, pp. 267–269.—Meyrick, 1917, Trans. Ent. Soc. London, p. 6, 1924, Exotic Microlepidoptera, vol. 3, pp. 108–109; 1930, op. cit., vol. 3, pp. 606–608; 1932, op. cit., vol. 4, p. 254; 1936, Arb. Morph. Taxon. Ent. Berlin, vol. 3, p. 104.—Clarke, 1958, Catalogue of the type specimens of Microlepidoptera . . . described by Edward Meyrick, vol. 3, p. 195.

TYPE SPECIES.—*Pseudatteria potamites* Walsingham, 1913 (by monotypy and original designation.)

DESCRIPTION.—Head smooth, sides of vertex with longer and raised scales. Antenna simple or pseudoserrate, in male densely short ciliated and with setae protruding; cilia not longer than width of antennal shaft, setose in female only; scapus long, somewhat flattened. Labial palpus about four times width of eye or even longer, porrect, slightly curved downward; basal segment pronounced; second segment with appressed scales, longest of all segments, almost uniformly broad along whole length; terminal segment rather long, acute. Proboscis moderate. Thorax smooth.

Forewing smoothly scaled, elongate-subovate; costa strongly arched; apex broadly rotundate, termen obliquely convex; tornus broadly rotundate; dorsum almost straight, basally arched. No costal fold in male. Twelve veins, all separate; S_e very gently bent; R_1 from before middle of discal cell; R_2 more than twice as near to R_3 as to R_1; R_3 twice as remote from R_4 as R_4 is from R_5; latter vein running to apex; internal vein of discal cell from between R_1 and R_2; M_1, M_2, M_3, and Cu_1 almost equidistant; Cu_1 from lower angle, Cu_2 from about two-thirds of discal cell; A_1 weak; basal fork of A_{2+3} shorter than one-fourth of entire vein.

Hindwing subtrapezoidal, slightly narrower than or as broad as forewing; costa almost straight or slightly undulate; apex rotundate; termen flat or slightly sinuate; tornus broadly rotundate; dorsum very slightly convex, strongly curved basally. Eight veins; S_c almost straight; R and M_1 more or less approximated in basal third, then diverging; M_2 and M_3 parallel; M_3 and Cu_1 connate or slightly separate at lower angle of discal cell; Cu_2 from three-fourths of discal cell; all three of anal veins present. No cubital pecten.

MALE GENITALIA.—Eighth abdominal segment with large lateral coremata bearing clusters of long hairs. Uncus moderately long, elongate-scaphiform, flatly calathiform or somewhat obcordate, in last two cases on a narrow stalk, or equally broad, slightly flattened dorsoventrad, and with a transverse, ventral carina; tip of a scaphiform or calathiform uncus generally with an apical thorn directed ventrad and often with a small papilla at base of this thorn; middle process of gnathos short; socius weak, haired, more or less dilated, pendant, and with a broad base. Tegumen rather broad with narrow pedunculi. Valva in folded position rotundate-foliaceus, oblong; costa sometimes strengthened, especially at base, occasionally with a rudimentary harpe; sacculus generally somewhat dilated at base. Fultura superior as a simple, transverse bar; vallum penis generally with a more or less large, finely spinose lamina praeputialis; fultura inferior rather high. Aedeagus generally thick and somewhat stout, occasionally rather slender, in both cases with a process at tip, and in distal portion sometimes with little scobination; caulis practically absent; coecum penis rather rudimentary; a strong generally conriform cornutus, sometimes also a cuneus of minute, more or less numerous thorns.

FEMALE GENITALIA.—Papillae anales pelmiform, oblong, soft, and haired. Sinus vaginalis wide, more or less infundibular. Antrum shortly tubular, as wide as sinus vaginalis or narrower, generally with lateral colliculi, one on each side of antrum; no separate ductus bursae; corpus bursae elongate, sometimes very long; cervix bursae not differentiated, united with corpus bursae, generally stronger sclerotized than latter and sculptured, and merely perceptible morphologically as receiving ductus seminalis; in subgenus *Pseudatteria* cervical section of corpus bursae broader than antrum, in remaining subgenera only as broad as antrum, and fused with it; cestum generally present, located in cervical section of corpus bursae, generally shaped as a strongly sclerotized, elongate plate, as a rule with serrate margins and a narrow, longitudinal carina; signum (if present) shaped as a rather small, generally scobinate plate or an indistinctly outlined area with or without a transverse carina.

REMARKS.—Among the Neotropical Tortricidae the species of the genus *Pseudatteria* are the most striking moths, which, with their

bright color and characteristic markings of the wings, might be compared only with the species of the tortricid genera *Atteria* Walker (tribe Anacrusiini) and *Idolatteria* Walsingham (tribe Archipini). The external morphological characters, like the long labial palpi and the vein R_5 of the forewing leading to the wing apex, make the separation of the *Pseudatteria* species from these two genera very easy, and the genitalic characters permit their recognition at once as members of the tribe Polyorthini.

Both male and female genitalia provide the bases for a division of the genus *Pseudatteria* into three subgenera, *Pseudatteria* Walsingham, sensu stricto, *Eurynatteria*, new subgenus, and *Sphaeratteria*, new subgenus, as they are defined in this paper. Only the external morphological characters, common in all three of the above subgenera, restrain the present author from raising them to the generic status.

In respect to the markings of the wings the *Pseudatteria* species might be divided into four groups, independent from the subgeneric division:

1. Markings of forewing consist of more or less broad, black marginal streaks, variously numerous, and perpendicular or slightly oblique to costa and termen; no spots on dorsum; some occasional, scarcely developed spots in internal area of forewing; subcostal area of forewing white, variously broad; apicoterminal portion of forewing also white, very broad; remaining portion of forewing and hindwing orange; latter with some white in cilia only and with black spots on margins; no internal spots on hindwing (*volcanica* Butler; *splendens* Druce; *cladodes* Walsingham; *bradleyi*, new species; *chrysanthema* Meyrick; *igniflora* Meyrick; *shafferi*, new species; *dognini*, new species; *tremewani*, new species; *maenas* Meyrick; and *pseudomaenas*, new species).

2. Black marginal streaks of forewing as in former group, in some species narrower and more numerous; as a rule spots on dorsum present; internal area of forewing generally with very numerous and well-developed spots; white subcostal area of forewing almost as broad as in group 1, or narrower to completely lacking; white apicoterminal area of forewing always narrower or lacking; hindwing with spots on margins and in internal area (*symplacota* Meyrick; *fumipennis* Dognin; *ardoris*, new species; *leopardina* Butler; *marmarantha* Meyrick; *myriocosma* Meyrick; *unciana* Dognin; *pantherina* Felder; *heliocausta* f. *baccheutis* Meyrick). The nominate form of *heliocausta* Dognin shows the characters intermediate between the two groups, having on the forewing no dorsal spots and no or only some occasional, internal spots, and the hindwing well spotted in the internal area.

3. Dark markings of forewing confluent, leaving ground color of

forewing in form of spots; hindwing with internal spots separate or confluent (*dictyanthes* Meyrick; *buckleyi* Druce).

4. Markings of wings greenish blue; costal spots of forewing less numerous than in three preceding groups; two very broad, transverse bands, and a large spot in external portion of forewing; hindwing with internal spots confluent or separate (*cantharopa* Meyrick; *analoga*, new species).

REMARKS.—There are no field or other observations on the living moths of the genus *Pseudatteria*, and no information is yet present about the natural enemies of these insects. Consequently nothing is known about the biological significance of the bright colors of the moths in question, and any treatment of these colors as being sematic would be based merely on pure speculation. Nevertheless, it is important to emphasize that the *Pseudatteria* species have their analogies among Neotropical Lepidoptera belonging to different families. This resemblance is in some cases so deceiving that it may mislead (and already has misled) taxonomists and cause misinterpretations of the systematic position of moths (see Appendix at the end of this paper). If the resemblance of the *Pseudatteria* species to those of two other tortricid genera, *Atteria* and *Idolatteria*, might in some way be explained by the law of homologous series in variation (Vavilov, 1922), this explanation appears hardly applicable to the cases of a remote relationship. For instance, many species of the oecophorid genus *Eumimographe* Dognin have not only the color but also the details of the wing markings of at least three pattern types as they have been observed in the genus *Pseudatteria*. Only the sizes of the moths, shapes of the wings, and other morphological details disclose the different family membership of these species. The zygaenid species *Euclimacia tortricalis* Druce exactly reproduces the color and wing markings of *Pseudatteria volcanica* or some other species of the pattern group 1. The above resemblance is in no way less complete than in the classical examples of mimicry of some South American Rhopalocera. It should be mentioned that the *Pseudatteria* species and their analogues, which belong to other families of the Lepidoptera, inhabit the same localities in many cases.

Chronologically Meyrick (1912) was the first to introduce the generic name *Pseudatteria* in the literature, crediting this name to Walsingham, and writing "*Pseudatteria* Wals. Biol. Centr. Amer. 4 (ined.)." In his catalogue of the Tortricidae, in which the above quotation was published, Meyrick did not establish any new genus, and there is no reason to suppose that he intended to make an exception for *Pseudatteria*. Later, Meyrick ("15th March 1913") gave a description of this genus and named *volcanica* Butler, one of the *Pseudatteria* species of his above catalogue, as its type species. He

again cited Walsingham as the author of the generic name, with the same remark "ined." This repeated citation of *Pseudatteria* as an unpublished name showed clearly that Meyrick did not recognize his paper of 1912 as validating the publication of this genus.

In the meantime, Walsingham (1913) had published his *Pseudatteria* and indicated it as a new genus. He designated the new species *potamites* Walsingham (the only *Pseudatteria* species under this date) as its type species. Walsingham did not mention the publication of the genus *Pseudatteria* by Meyrick (1912), although Walsingham's paper was dated "February, 1913." It is quite clear that the publication of the above three papers, two by Meyrick and one by Walsingham, at almost the same time, gave these authors no chance to quote each other in a proper way. In accordance with this, it would be reasonable to reject the publication of *Pseudatteria* by Meyrick (1912), recognizing it as unavailable because this author himself attributed this name to Walsingham, declared it as being unpublished, and did not mention anywhere that he was introducing this name as a new taxon. For these reasons, the genus *Pseudatteria* should become available with the date of its publication by Walsingham (1913), with *potamites* Walsingham as the type species of this genus. A corresponding proposal to place the generic name *Pseudatteria* Walsingham (type species: *potamites* Walsingham) on the "Official List of Generic Names in Zoology," and the name *Pseudatteria* Meyrick (type species: *volcanica* Butler) on the "Official Index of Rejected and Invalid Generic Names in Zoology," has been submitted by the present author to the International Commission on Zoological Nomenclature. The purpose of this proposal is to legalize the authorship of Walsingham for the genus in question. The decision of the Commission cannot substantially influence the existing designation of the type species of the genus *Pseudatteria* because *volcanica* Butler and *potamites* Walsingham are conspecific.

Key to the *Pseudatteria* Species

1. Forewing with two broad, greenish-blue bands crossing wing transversely from costa to dorsum; a large, concolorous spot distad of these bands . . 2
   Forewing without such bands 3
2. Large, greenish-blue spot in distal third of forewing, extended to costa and touching it . . . . . **analoga,** new species
   Large, greenish-blue spot in distal third of forewing, remote from costa and dorsum . . . . . **cantharopa** Meyrick
3. Forewing with orange or somewhat yellow spots on dark-blue ground, or with such spots separated from each other by black interspaces 4
   Forewing with more or less numerous, black, sometimes slightly prismatic spots and/or streaks on white, orange or somewhat yellow ground . . . 5

4. Hindwing with black spots merely on and near wing margins. **dictyanthes** Meyrick
   Hindwing with black spots in central area, in male occupying a large surface and frequently confluent . . . . . **buckleyi** Druce
5. Both wings densely covered with spots and streaks; confluent, arranged in more or less regular, transverse rows which are smaller and more numerous on forewing . . . . . **myriocosma** Meyrick
   Forewing with more or less heavy streaks and/or spots on costa, termen, and in some species also on dorsum; hindwing also with spots on margins; if spots also present in central areas of wings, then not very dense and not arranged in transverse rows 6
6. Spots in central areas of wings present, at least on hindwing 7
   No spots in central areas of both wings, or occasional ones on forewing. 15
7. Interspaces between most of broad costal streaks of forewing with narrower and shorter, almost linear streaks . . . . . **unciana** Dognin
   All of costal streaks of forewing almost equally heavy, none of them linear. 8
8. Interspace between cubital vein of discal cell, vein Cu_2, and A_1 of hindwing with at least four spots following each other and not overstepping these veins 9
   Interspace below cubital vein of discal cell and vein Cu_2 of hindwing with not more than three spots, all of them overstepping vein A_1, or no spots in this area 10
9. Costa of forewing with twelve black, moderately broad, at greatest part somewhat crooked streaks, some of them roundly or irregularly dilated toward tips; a straight, narrow, longitudinal streak and below it two transverse streaks forming an 88-shaped figure, all three in subterminal area in front of three central terminal streaks . . . **ardoris,** new species
   Costa of forewing with eleven black, rather broad streaks not dilated at tips, most of them not crooked; in subterminal area of forewing not more than two broad streaks or irregularly shaped spots in front of three central terminal streaks . . . . . **heliocausta** Dognin
10. Subterminal spots of forewing arranged in a distinctly arcuate, although slightly broken row . . . . . **leopardina** Butler
    Subterminal spots of forewing not forming any regular row, or missing. . 11
11. Forewing without subterminal spots; upper of terminal streaks reaches imaginary line drawn between penultimate costal streak and tornal spot. **maenas** Meyrick
    Subterminal area of forewing with spots and/or streaks; terminal streaks almost equally long among themselves, and upper of them not reaching inwards deeper than others 12
12. Subterminal area of forewing without any longitudinal streaks, only with more or less rotundate, ovate, or irregularly shaped spots 13
    Subterminal area of forewing with spots and at least with one longitudinal streak 14
13. One of submarginal spots of forewing many times larger than others and generally touching some of external costal streaks; most of terminal spots of hindwing confluent . . . . . **marmarantha** Meyrick
    Subterminal spots of forewing almost equally sized, or some of them only slightly larger than others; terminal spots of hindwing distinctly separated. **pantherina** Felder

14. Forewing with more or less large, almost equally sized streaks, following more or less regularly one after another along entire dorsum; subterminal longitudinal streaks of forewing close to terminal spots, and crossing white area not deeply intrusive into orange area . . **symplacota** Meyrick

Dorsal spots of forewing irregularly distributed along dorsum, and some of them distinctly larger than others; a longitudinal streak, located in orange area of forewing, precedes two irregularly rotund, submarginal spots . . . . . **fumipennis** Dognin

15. Apical and one or two terminal streaks of forewing forming a fork connected with a longitudinal, subterminal streak crossing entire width of white area. **pseudomaenas,** new species

Furcate spots of forewing formed either by streaks other than above or by same apical and terminal streaks, but then no longitudinal streaks completely crossing subterminal area; or no furcate spots on forewing . . 16

16. Costa of forewing with not more than nine streaks 17

Costa of forewing with more than nine streaks 20

17. Preapical costal streak of forewing not furcate and not connected with apical streak; penultimate costal streak longest of all on forewing. **shafferi,** new species

Two preapical streaks of forewing forming a fork, separate or connected with apical streak 18

18. Preapical and penultimate costal streaks of forewing forming a fork with a long "handle" obliquely crossing white area and intruding into orange area; tornal spot of forewing connected with trifurcate terminal spot above it; hindwing with a large apical spot and three smaller, separate terminal spots . . . . . **tremewani,** new species

Apical and two preapical costal streaks of forewing forming a complicate, biradiate fork with secondary, occasionally varicate branches and without a "handle"; hindwing with apical spot and upper of terminal spots connected 19

19. Two central terminal spots of forewing forming a short fork connected with a rather rotundate tornal spot . . . . . **bradleyi,** new species

Two central terminal spots of forewing forming a fork separated from elongate tornal spot . . . . . **igniflora** Meyrick

20. Forewing with two terminal spots and these with not more than two terminal points . . . . . **chrysanthema** Meyrick

Forewing with not less than four terminal spots or with not less than three terminal points of these spots 21

21. Forewing with a fork formed by three lower, adjacent terminal spots. **splendens** Druce

Forewing with a fork formed by two lower, adjacent terminal spots; or forks formed by some other, not adjacent terminal spots; or none of terminal spots furcate 22

22. Only third costal streak before apex of forewing longer than remainder of costal spots . . . . . **dognini,** new species

Penultimate, occasionally also third of costal streaks before apex of forewing longer than remaining costal spots 23

23. Apical and lower of terminal spots of forewing much broader than a terminal spot between them . . . . . **cladodes** Walsingham

Terminal spots of forewing almost equally broad among themselves; apical spot of forewing occasionally broader . . . . . **volcanica** Butler

Subgenus *Pseudatteria* Walsingham, new status

SYNONYMY.—As listed above for the genus.

TYPE SPECIES.—*Pseudatteria potamites* Walsingham, 1913; by monotypy and original designation.

MALE.—Uncus elongate, somewhat scaphoid, at least in apical portion, as a rule with an apical thorn directed ventrad, and generally with a soft papilla ventrad to base of this thorn. Vesica with a large cornutus, and generally with a cuneus composed of minute thorns.

FEMALE.—Antrum well defined, subcylindrical, narrower than sinus vaginalis and adjacent portion of corpus bursae; lateral colliculi generally present. Cervix bursae indicated by a stronger sclerotization and striation.

Pseudatteria (Pseudatteria) dognini, new species

PLATE 1

Antenna brownish black with white annulation. Labial palpus black, at base and inner surface white scaled. Head yellowish white with a black median line dilated into a round, preoccipital spot. Thorax [damaged; probably black, as some scales preserved in posterior portion] yellowish white laterally; tegula black with external fringes yellowish white. Abdomen orange. Forewing orange, in subcostal and apicoterminal areas yellowish white; markings bluish black, arranged as follows: ten costal streaks, some of them penetrating into orange area; penultimate of these streaks (ninth, counting from wing base) much longer than others and spotlike dilated at tip; last (tenth) of costal streaks U-shaped, resting with its branches on costa before wing apex; two similarly shaped streaks, one on wing apex, another on termen above tornus, and a much smaller, rotundate terminal spot between them; a rather large, semirotundate spot on tornus; an 8-shaped spot oblique basad, located on border of white and orange areas, in front of interspace between tornal spot and mentioned U-shaped terminal streak above it; cilia bluish black in front of terminal streaks and spots, and white in interspaces. Length of forewing 14–15 mm. Hindwing orange with black, rotundate marginal spots: a large spot on wing apex, connected by a blackish shadow with two spots, one of them a smaller spot on end of costa, another spot slightly smaller than latter spot and located close to lower portion of apical spot, basad of it; three rather large spots on termen, first of them close to apical spot; a small dot closely following last of terminal spots, and two much smaller, widely remote dots on dorsum; in male a little, additional dot below and slightly basad of lower spots accompanying apical spot; cilia black in front of spots, and orange or whitish in interspaces.

MALE GENITALIA.—Uncus with a narrow stalk ending with a rotundate, flatly calathiform-dilated apex with an acute point directed ventrad and accompanied by a little, haired papilla. Valva subrectangular with external margin rotundate; sacculus slightly dilated at base, and narrowly prolonged along ventral margin (of a folded) valva. Aedeagus rather slender with a slightly curved apical process; cornutus with two basal branches and a small, conical cap on apex; cuneus indiscernible.

FEMALE GENITALIA.—Sinus vaginalis with a trapezoidal lamella antevaginalis. Antrum short, tubular with two slightly arcuate colliculi remote one from another. Cervical portion of corpus bursae with fine, longitudinal striation and a stronger sclerotized, oblique striation probably representing a modified cestum; corpus bursae long and narrow; signum ovate.

TYPES.—Holotype, USNM 67566, male (genitalia on slide 2-Obr., Jan. 22, 1961), Loja vicinity, Loja, Ecuador, 1887 (Dognin Collection), allotype, USNM, female (genitalia on slide 4429, JFGC), El Monje near Loja, Loja, Ecuador, 1893 (Dognin Collection).

REMARKS.—Very similar to *shafferi*, new species, but differs from it in the shapes of the terminal markings and the subterminal spot of the forewing. Also the apical spot and the terminal spots of the hindwing are of different shapes and in *dognini* much larger. The female genitalia of both species differ in the shapes of the lamella antevaginalis, colliculi, striation of the cervix bursae, and the signum.

Besides the types of *dognini*, there is in the U.S. National Museum a female specimen from Loja vicinity, Ecuador (pl. 1, fig. 7), somewhat resembling this species, and differing from it in the details of the wing markings. The costal streaks of the forewing of this specimen are distinctly less oblique than in *dognini*, the penultimate and the last of them are simple, and two separate spots are located internobasad of these streaks and the streak preceding the penultimate one. Also the apical spot of the hindwing is replaced by a group of three separate spots. It is quite possible that this specimen might be a variety of *dognini*, but this cannot be proven presently because the abdomen of the moth is missing.

***Pseudatteria (Pseudatteria) shafferi*, new species**

PLATE 2

FEMALE.—Antenna black with few whitish, scattered scales. Labial palpus black, white on scapus and largest portion of inner surface of second segment. Head [worn] with black face and white scales around it. Thorax blue black with scattered, whitish scales; tegula blue black with cream-yellow emargination. Abdomen orange.

Forewing orange, white in subcostal and apicoterminal areas; markings bluish black, arranged as follows: nine streaks on costa, penultimate of them (eighth, counting from wing base) longest and dilated at tip; a trifurcate streak with short branches resting on wing apex and termen below it; another trifurcate streak with short branches resting on termen above tornus; a semirotundate spot on tornus, on border of white and orange areas: on elongate spot, slightly oblique basad, and located between tornal spot and penultimate costal streak; cilia black in front of streaks, and white in interspaces. Length of forewing 14 mm. Hindwing orange with purple-black spots: a large apical spot, composed of two confluent spots, one at end of costa, another on wing apex; five much smaller spots on termen; cilia black in front of terminal spots, twice checked with white at apical spot, and white in interspaces between apical spot and three following terminal spots; remainder of cilia orange with a black dot on tornus, basad of last terminal spot.

MALE.—Unknown.

FEMALE GENITALIA.—Sinus vaginalis with a subtrapezoidal, somewhat obtusely pointed lamella antevaginalis on middle of caudal margin. Antrum short, tubular with incurved sides, and with broad, curved colliculi touching each other at middle of antrum. Cervical portion of corpus bursae membranous caudally, slightly dilated and covered with a dense, sclerotized, rather disorderly, longitudinal striation at middle, and again narrowed cephalically; cestum indicated by a laterocaudal sclerotization in striated area of cervix bursae; corpus bursae long and narrow; signum with an arcuate, transverse carina dividing it in an open, not well-defined caudal area and a subtriangular cephalic area narrowly extended cephalad.

TYPE.—Holotype, ♀ (genitalia slide 8680), Guainia ("Upper Rio Negro"), Vaupés, Colombia, 800 m. (A. H. Fassl); BM.

REMARKS.—Very similar to *dognini*, new species, and compared with it in the description of the latter. In the female genitalia, *shafferi* is also rather close to *tremewani*, new species, but has no external similarity to it. This species is named for M. Shaffer of the British Museum (Natural History) for recognition of his kind assistance in the preparation of the genitalia slides for the present author's studies on the Neotropical Tortricidae.

***Pseudatteria (Pseudatteria) pseudomaenas*, new species**

PLATE 3

Antenna black with whitish spots on some segments. Labial palpus black with basal segment, and inner surface and dorsal edge

of second segment cream white. Head cream white with a large, black, triangular spot on vertex. Thorax cream white with black spots, one anteriorly, and two posteriorly; tegula black with cream-white emargination. Forewing orange with costal and apicoterminal areas cream white; markings black, arranged as follows: eleven streaks on costa; one streak on apex, successively connected with two terminal streaks below apex and a broader, straight, longitudinal, subterminal streak reaching to imaginary line drawn between third costal streak (counting from wing apex) and upper tornal streak, and thus forming a trivaricate fork with long "handle"; two more terminal streaks below this fork, and two tornal streaks, occasionally connected by their tips; two round or slightly elongate subterminal spots internad of last terminal and upper tornal streaks, connected with themselves and occasionally with mentioned streaks; a minute dot basad or dorsobasad of "handle" of fork; a minute dot dorsad of tip of sixth costal streak (counting from wing apex); cilia black in front of streaks, and white in interspaces. Length of forewing: male 11 mm.; female 14 mm. Hindwing orange with nine black spots on margins; two largest of them on end of costa and wing apex; remaining spots along termen and tornus; interspaces of upper seven of these spots yellowish white; cilia concolorous with spots and interspaces.

MALE GENITALIA.—Uncus with a long stalk ending with a dilated, ovate-calathiform apex bearing a thorn directed ventrad. Valva subrectangular, slightly oblong with external margin rotundate; sacculus slightly dilated at base and narrowly prolonged along ventral margin (of a folded) valva. Aedeagus rather slender with a narrow apical process; cornutus with an apical cap and narrow, basal extension; cuneus indiscernible.

FEMALE GENITALIA.—Sinus vaginalis flatly infundibular; lamella antevaginalis with a rotundate-trapezoidal dilatation at middle. Antrum slightly longer than broad, incurved laterally; two lateral colliculi touching each other at middle of antrum. Cervical portion of corpus bursae striated; no cestum discernible; corpus bursae narrow, moderately long: no signum.

TYPES.—Holotype, ♂ (genitalia slide 8668), and allotype, ♀ (genitalia slide 8669), Costa Rica, April 1924 (Janson); BM.

REMARKS.—This new species is known in two specimens, a male and a female, well matching each other. Very characteristic of the species is a longitudinal streak in the subterminal area of the forewing, looking like a "handle" of a trivaricate fork formed by the apical and two terminal streaks. The species might remind one of *maenas* Meyrick, but in the latter the longitudinal steak is formed by the upper terminal streak, is broader and shorter than in *pseudomaenas*, and

has no fork at the termen. Moreover, *maenas* has only 10 costal streaks of the forewing, and they are somewhat heavier, the external ones distinclty longer, and the internal area of the forewing has many round, rather large, black spots. Also the spots of the hindwing are different in the two species. The lamella antevaginalis of *pseudomaenas* has no sclerotized caudal line, and the striated area of the cervical portion of the corpus bursae and the entire corpus bursae are shorter than in *maenas*.

Pseudatteria (Pseudatteria) maenas Meyrick

PLATE 4

Pseudatteria maenas Meyrick, 1924, Exotic Microlepidoptera, vol. 3, p. 109.—Clarke, 1955, Catalogue of the type specimens of Microlepidoptera in the British Museum described by Edward Meyrick, vol. 1, p. 195; 1958, op. cit., vol. 3, p. 196, pl. 98, figs. 4–4b.

FEMALE GENITALIA.—Sinus vaginalis wide, very flatly infundibular; lamella antevaginalis semicircular with a narrowly sclerotized caudal margin. Antrum as long as broad, deeply incurved laterally; colliculi lateral, rather broad, each with a narrow, strongly sclerotized streak externally. Cervical portion of corpus bursae rather long with longitudinal, slightly undulate striation, laterocaudally with an elongate, strongly sclerotized patch (?cestum); corpus bursae long and narrow; signum indiscernible.

TYPE.—Holotype, ♀ (genitalia slide 4531, JFGC), Chiriqui, Panama, 1899 ("R."); BM.

OTHER SPECIMEN EXAMINED.—♀, Las Lagunas, El Volcan Chiriqui, Panama, Jan. 28, 1948 (R. E. Ellison); BM.

REMARK.—No males are known.

Pseudatteria (Pseudatteria) tremewani, new species

PLATE 5

FEMALE.—Antenna blackish brown. Labial palpus cream yellow; terminal segment and outer surface of second segment blackish brown. Head cream yellow, slightly orange around eyes, and with a black spot between antennae and occiput. Thorax reddish orange; black dots on shoulder of tegula, and an occasional, black spot at middle of thorax. Abdomen reddish orange, occasionally black on tip. Forewing deep reddish orange, in subcostal and apicoterminal areas white; markings black, arranged as follows: nine streaks on costa, smallest of them at wing base, and each following, somewhat longer than preceding one; penultimate and preapical costal streaks (eighth and ninth, counting from wing base) forming a fork with a heavy, oblique "handle" slightly capitate at tip and intruding into orange

area; a rather triangular or somewhat elongate spot at wing apex and apical portion of termen, trivaricate or quadrivaricate toward them; an elongate spot, bivaricate or trivaricate externad, located on termen beneath former spot, with lower, internal portion connected with upper portion of a large tornal spot, and thus forming a common tornoterminal spot touching wing margin at three or four points; preapical costal streak, apicoterminal spot, and tornoterminal spot occasionally connected by means of narrow crosspieces; cilia black in front of markings, and white in interspaces. Length of forewing 14–15 mm. Hindwing reddish orange with black spots: a large spot on wing apex, two smaller spots on termen below former spot, and one or two more, smallest, on tornus and dorsum; cilia black in front of spots, white in interspace of apical and upper of terminal spots, sometimes white also in next interspace, and reddish orange in others; some occasional grayish or blackish dots in white or orange interspaces of cilia.

MALE.—Unknown.

FEMALE GENITALIA.—Sinus vaginalis flat with a narrow lamella antevaginalis. Antrum cylindrical, slightly longer than broad; two large, lateral colliculi, each with a longitudinal, strongly sclerotized streak. Cervical portion of corpus bursae with a strong, longitudinal, somewhat disorderly striation; no cestum discernible; corpus bursae long and moderately broad; signum ovate.

TYPES.—Holotype, ♀ (genitalia slide 8678), Cuzco, Peru, January 1901 (Garlepp); BM. Paratypes: ♀, Peru; DEI. 2 ♀♀ (genitalia slide 8677), La Merced ("La Mercede"), Junin, Peru, 2000–3000 ft. (Walkins); BM. 2 ♀♀ (genitalia slides 8675, 8676), Bolivia (nos. 71078, 13496); BM. 3 ♀♀ (genitalia slides 4439, JFGC, and 8670), Rio Zongo ("Songo"), Bolivia, 750 m. (A. H. Fassl); BM. ♀, same data; USNM. ♀, same data; DEI.

REMARKS.—In the genitalia this new species is rather close to the new species *shafferi* and *dognini* but differs from them in the shape of the colliculi and the striation of the cervical portion of the corpus bursae. Moreover, *tremewani* is completely unlike both of these species in the wing markings. It is more like *chrysanthema* Meyrick, but has the tornoterminal spot never divided, and always separated from the wing margin by several white spaces. The arrangement and the shapes of the spots on the hindwing and the genitalia are quite different in *tremewani* and *chrysanthema*. The species is named for W. G. Tremewan of the British Museum (Natural History) in recognition of his kind assistance in the dissections of moths; also the author is grateful for having his attention drawn to all characters observed as new or rare in the slides, including this new species.

***Pseudatteria (Pseudatteria) chrysanthema* (Meyrick)**

PLATES 6, 7, 41

Atteria chrysanthema Meyrick, 1912, Trans. Ent. Soc. London, for 1911, p. 676.—Clarke, 1955, Catalogue of the type specimens of Microlepidoptera in the British Museum described by Edward Meyrick, vol. 1, p. 88.

Pseudatteria chrysanthema.—Meyrick, 1912, *in* Wagner, Lepidopterorum catalogus, pt. 10, p. 16; 1913, *in* Wytsman, Genera insectorum, fasc. 149, p. 22.—Clarke, 1958, Catalogue of the type specimens of Microlepidoptera in the British Museum described by Edward Meyrick, vol. 3, p. 195, pl. 97, figs. 3–3c.

FEMALE GENITALIA.—Sinus vaginalis wide, flatly infundibular; lamella antevaginalis narrow, obtusely angulate cephalad. Antrum short and almost regularly cylindrical; cervical portion of corpus bursae with fine, sometimes harldy discernible striation; cestum short, occasionally vestigial, generally with a longitudinal carina; corpus bursae long, rather broad; signum scobinate, rather triangular.

TYPES.—Lectotype, female (genitalia on slide 4435, JFGC), "San Augustin," Colombia, 3500 ft., September 1895 ("S."); BM. One lectoparatype, female, Iquitos ("Yquitos"), Loreto, Peru, 1906 ("S."; Meyrick Collection); BM.

OTHER SPECIMENS EXAMINED.—Colombia: ♀, no exact data; DEI. ♀, Bogotá, Cundinamarca (J. G. Foetterle); VMNH. 2 ♀♀, Guainia ("Ober Rio Negro"), Vaupés, 800 m. (A. H. Fassl); BM. Venezuela: 2 ♀♀ (genitalia of one on slide 636-Obr.), no exact data; AMNH. British Guiana: ♀, no locality data, November–December 1902 (C. B. Roberts); BM. ♀, Georgetown, Demerara (Casbell); BM. ♀, Akaima ("Fort Akayma"), Rio Demerara; AMNH. 2 ♀♀, Berbice (Crowley); BM. Ecuador: ♀, no exact data (S. E. Cassino Collection); MCZ. ♀, Zamora, May 1886; USNM. 4 ♀♀, Loja vicinity, Loja, 1883, and 1887; USNM. ♀ (genitalia slide, prepared by A. Busck on Mar. 30, 1926), El Monje near Loja, Loja, 1893 (Dognin); USNM. Peru: ♀, no exact data (M. de Mathan); BM. 2 ♀♀, Cuzco, January 1901 (Garlepp); BM. 5 ♀♀ (genitalia of one on slide 8655), Rio Chanchosmayo ("Chanchamayo"), Cuzco, June-August 1901 (Hofmann), 1898, and 1912 (O. Schuncke); BM. 2 ♀♀, La Merced, Junin (R. Toro), and 1915 ("W."; Meyrick Collection); BM. ♀, Rio Colorado, Junin, 2500 ft., August 1903 (Watkins and Tomlinson); BM. ♀ (genitalia slide 4436, JFGC), Moyobamba, San Martin, "1er Sem." 1887 (M. de Mathan); USNM. ♀, Tarapoto, San Martin, May-August 1885 (M. de Mathan); BM. Bolivia: 6 ♀♀, no exact data (71076, 71077; Rolle Heyne, 13497–13499; Germain); BM. ♀, Rio Zongo ("Songo"), 750 m.; VMNH. ♀ (genitalia slide 67-Obr., 1963), same locality, 2500 ft., 1930 ("Z."); USNM. 2 ♀♀, Chapare, 400 m., July 15, 1948, and Aug. 5, 1950 (R. Zischka); ZSM. ♀, Prov. del Sara, Santa Cruz, 450 m. (J. Steinbach; Meyrick Collection); BM.

♀, Buena Vista, Santa Cruz, 750 m., August 1906 to April 1907 (J. Steinbach); BM. 4 ♀♀, "Yungo del Espiritu Santo," Cochabamba, 1888–1889 (P. Germain); BM. Brazil: ♀, Castro, Parana (E. D. Jones; Meyrick Collection); BM

REMARKS.—The male of *chrysanthema* is not known. The species is very similiar to *splendens* Druce and in some specimens hardly distinguishable from it. In *splendens* the external indentation of the subapical terminal spot of the forewing is noticeably deeper than in *chrysanthema* (in which this indentation often is completely lacking), usually being represented by two white notches, at least as deep as the width of the cilia; the spot itself is separated from the tornal spot by a rather broad, white interspace. In *chrysanthema* there is an additional spot between the subapical and the tornal spots of the forewing; the interspace between this additional spot and the tornal spot is very narrow, or both these spots are confluent. The above characters are rather reliable for identification of the specimens with the cilia undamaged, but in those with the cilia broken they may sometimes not be very distinct. On the hindwing of *chrysanthema* the subapical spot is followed by one or two small, black terminal spots which are much smaller than the adjacent spot on the termen. In *splendens* the subapical spot of the hindwing is generally confluent with the apical spot; if both of these spots are separated, the subapical spot is larger than the terminal spot next below. The female genitalia of these two species enable an easy separation of both.

***Pseudatteria* (*Pseudatteria*) *analoga*, new species**

PLATE 8

FEMALE.—Antenna brown black with violet gloss. Labial palpus brown black with bluish-violet gloss; basal segment and inner surface and base of upper edge of second segment orange yellow. Head orange yellow; vertex brown black with bluish-violet gloss. Thorax [damaged] concolorous with vertex and with scattered, orange-yellow scales; patagia and fringes of tegula orange yellow. Abdomen prismatic greenish blue. Forewing orange yellow with prismatic greenish blue, fine black-outlined markings, as follows: a broad, transverse, somewhat undulate-outlined band, located in basal third of wing and slightly narrowed costally; a similar, slightly broader band at middle of wing; a large, piriform spot located in external third of wing, narrowly extended costally and reaching costa, and remote from dorsum; two moderately sized spots near base of wing, one on costa, another on dorsum; a minute, costal dot external of these spots, before first band; two moderate, rotundate costal spots, one in interspace of first and second bands, another

between latter band and piriform spot; two minute dorsal dots in same interspaces, each one opposite above-mentioned costal spots; eight variously shaped marginal spots, two of them in external portion of costa, one on wing apex, four on termen (some of them connected by tips), and one (largest spot) on tornus; cilia black in front of marginal markings, and orange yellow in interspaces. Length of forewing 13 mm. Hindwing orange yellow with black markings: large, irregularly shaped spots, confluent and occupying basal two-thirds of wing; a preapical spot on costa; an elongate spot extending from wing apex to upper portion of termen; a similar spot on termen, below former and separate from it; two smaller, rotund spots on tornus, touching external margin of confluent spots in inner area of wing; cilia orange yellow, in front of marginal spots black; at apicoterminal spot black portion of cilia divided by orange yellow.

MALE.—Unknown.

FEMALE GENITALIA.—Sinus vaginalis wide with a narrow lamella antevaginalis. Antrum tubular, broader than long; two narrow, lateral colliculi; cervical portion of corpus bursae finely striated, closer to antrum with numerous, variously sized, flat, sclerotized thorns arranged in form of a girdle; cestum elongate, serrately outlined, with a narrow, stronger sclerotized carina; corpus bursae elongate, moderately broad; signum shaped as a semirotundate plate, perpendicular to surface of corpus bursae, and resting on a weakly sclerotized area.

TYPE.—Holotype, ♀ (genitalia on slide B.6), Rio Tanampaya, La Paz, Bolivia, 1894 (Garlepp; Staudinger Collection); ZMB.

REMARKS.—Similar to *cantharopa* Meyrick, but differs in the shapes of the spots of the wings: the large, external spot of the forewing is extended costad and touches the costa; the marginal spots of both wings are larger and on hindwing less numerous. In accordance with the genitalia, these two species belong to different subgenera. In its appearance *analoga* is very similar to the gynandrous specimen of an unknown *Pseudatteria* species, described by the present author (Obraztsov, 1962). Until any detailed information about the normal moths of this unknown species from Peru and the male of *analoga* is available, it is difficult to discuss their relationship.

***Pseudatteria* (*Pseudatteria*) *unciana* (Dognin)**

PLATE 9

Atteria unciana Dognin, 1904, Ann. Soc. Ent. Belgique, vol. 48, p. 133.

Pseudatteria unciana.—Meyrick, 1912, *in* Wagner, Lepidopterorum catalogus, pt. 10, p. 16; 1913, *in* Wytsman, Genera insectorum, fasc. 149, p. 22.

FEMALE GENITALIA.—Sinus vaginalis very flat, rather tureen shaped than infundibular. Antrum broadly cylindrical, slightly

longer than broad; two linear, lateral colliculi; cervical portion of corpus bursae slightly broader than antrum, with striation consisting of fine lines crossing each other; cestum narrow, long, protruding striated area; corpus bursae long, rather narrow; signum rotundate cephalad, opened caudad.

TYPE.—Holotype, ♀ (genitalia slide 4-Obr. Feb. 24, 1961), Zamora, Ecuador, September 1886 (Dognin); USNM.

OTHER SPECIMENS EXAMINED.—Eucador: 3 ♀♀, Chiguinda (C Buckley); BM. 3 ♀♀, Intag ("Intaj") (C. Buckley); BM. 2 ♀♀ Baños, 2500 m., June-July 1936 (W. Clarke-Macintyre); VMNH.

REMARKS.—The male of this species is unknown.

Pseudatteria (Pseudatteria) myriocosma Meyrick

PLATE 10

Pseudatteria myriocosma Meyrick, 1930, Exotic Microlepidoptera, vol, 3, p. 608.—Clarke, 1955, Catalogue of the type specimens of Microlepidoptera in the British Museum described by Edward Meyrick, vol. 1, p. 212; 1958, op. cit., vol. 3, p. 199, pl. 99, figs. 2–2c.

FEMALE GENITALIA.—Sinus vaginalis wide, infundibular; lamella antevaginalis narrow. Antrum short, cylindrical with lateral colliculi vestigial; cervical portion of corpus bursae densely striated; cestum elongate, hidden in this striation; corpus bursae long and broad; signum with a transverse carina, cephalic portion triangular, serrately outlined, and caudal portion smooth, rotundate, almost obsolete.

TYPE.—Holotype, ♀ (genitalia slide 4426, JFGC), Cochabamba, Bolivia (Paravicini Collection); BM.

OTHER SPECIMEN EXAMINED.—1 ♀, Bolivia (ex Germain; Paravicini Collection); BM.

REMARKS.—Species of an appearance unique for the entire genus. The male is unknown.

Pseudatteria (Pseudatteria) pantherina (Felder)

PLATE 11

Atteria pantherina Felder, 1875, *in* Reise der Fregatte Novara, Zool., vol. 2, pt. 2, p. 3, pl. 139, fig. 41.

Pseudatteria pantherina.—Meyrick, 1912, *in* Wagner, Lepidopterorum catalogus, pt. 10, p. 16; 1913, *in* Wytsman, Genera insectorum, fasc. 149, p. 22.

FEMALE GENITALIA.—Sinus vaginalis wide, rather deeply tureen shaped than infundibular; lamella antevaginalis narrow. Antrum subcylindrical, broader than long with sides slightly incurved; colliculi narrow, lateral, curved as sides of antrum. Cervical portion of corpus bursae finely striated; cestum narrow and long; corpus bursae rather

long and broad; signum with a transverse carina separating a triangular, cephalic area from a flat, open, caudal area.

TYPE.—Holotype, ♀ (genitalia on slide 5773), Bogotá, Cundinamarca, Colombia (Lindig; 400161); BM.

OTHER SPECIMENS EXAMINED.—Colombia: 2 ♀♀, no locality data, 1915 (Meyrick Collection); BM. 1 ♀, Pacho, Cundinamarca, 2200 m. (H. Fassl); BM. 1 ♀, same data; USNM. 2 ♀♀, Bogotá, Cundinamarca (Lindig, Felder Collection, 400162; and Rothschild Collection); BM.

REMARKS.—The shape and size of the spots of the wings are slightly variable. The marginal streaks along the external portion of the costa and termen of the forewing are either separate or connected in pairs. On the hindwing the number of the spots is somewhat inconstant. The male of the species is unknown.

Pseudatteria (Pseudatteria) fumipennis (Dognin)

PLATE 12

Atteria fumipennis Dognin, 1904, Ann. Soc. Ent. Belgique, vol. 48, p. 133.
Pseudatteria fumipennis.—Meyrick, 1912, *in* Wagner, Lepidopterorum catalogus, pt. 10, p. 16; 1913, *in* Wytsman, Genera insectorum, fasc. 149, p. 22.

MALE GENITALIA.—Uncus rather long with a narrow basal stalk and a scaphiform, dilated and rounded apical portion ending with a short, acute point directed ventrad; a little, haired papilla closely approximate to this point, and located basad of it. Valva subrectangular with external margin rounded; sacculus short and rather broad, triangular. Aedeagus thick and stout with a narrow apical projection; vesica finely punctulate; cornutus large, stout with a short, strong, bent hook distally; cuneus shaped as a short, arcuate row of minute spines.

TYPE.—Holotype, ♂ (genitalia slide 3-Obr., Feb. 24, 1961), Micay, Valle del Cauca, Colombia, August 1896 (Dognin Collection); USNM.

REMARK.—The holotype is the only known specimen of the species.

Pseudatteria (Pseudatteria) ardoris, new species

PLATE 13

FEMALE.—Antenna black; scapus with a slight prismatic-blue luster. [Labial palpi missing.] Head dark prismatic blue; white emargination around eyes, dilated at face. Thorax dark prismatic blue; patagia, tegula, and posterior edge of mesothorax with white margins; lateral sides of metathorax with orange-yellow tufts of hairs. Legs black; lower edge of foreleg white; middle and hindlegs with white rings. Abdomen black with yellow rings. Forewing deep reddish orange, at costa and termen white; markings black, formed by numerous spots and streaks with a slight bluish or violet luster, and arranged as

follows: twelve broad, more or less subquadrate spots on costa, most of them continued distad as oblique, irregularly shaped streaks formed by confluence with a longitudinal row of rotundate, subcostal spots, only a few of which remain isolated; wing apex with a short, trifurcate streak fused with an ovate spot located basad; termen with three elongate, nearly 8-shaped, oblique streaks narrower than costal streaks; at tornus two rather large, rotund spots; dorsum with 10 spotlike streaks slightly inclined in different directions and occasionally touching each other with tips; five spots in discal cell, and one externad of it, forming a common, longitudinal row; the outer two more remote from each other and remaining spots of same row; a longitudinal streak being a continuation of this row and located close before upper of terminal streaks; two pairs of round spots beneath this longitudinal streak, one pair below other and before two lower of terminal streaks, and forming an 88-figure; four spots in interspace of veins Cu_1 and Cu_2; eight spots in interspace below discal cell and vein Cu_2; some minute dots in external wing portion and here and there between large spots; cilia black in front of spots, and white in interspaces. Length of forewing 14 mm. Hindwing concolorous with forewing but without white; at apex two large, rotundate spots touching each other; one subtriangular spot on costa before apex; five moderately sized spots on termen and tornus, and three larger ones on dorsum; two large, round spots forming a row beneath discal cell, and two smaller spots externad of it; two spots in interspace beneath vein Cu_2, external of these spots smaller; four large, somewhat unequally sized spots in vein interspace next dorsad of this row, and two small spots dorsobasad of basal of these four spots; cilia black or grayish in front of spots, orange or whitish in interspaces.

MALE.—Unknown.

FEMALE GENITALIA.—Sinus vaginalis flatly infundibular; lamella antevaginalis bandlike, narrow at middle, and slightly broader laterally. Antrum cylindrical, slightly longer than broad; colliculi lateral, vestigial; cervical portion of corpus bursae with a tangled striation; cestum rather narrow, elongate, at margins serrate, tapering cephalad, and divided by a narrow, mediolongitudinal carina; corpus bursae rather long and moderately broad; signum shaped as a smooth, elongate area, at middle with a transverse, stronger sclerotized fold.

TYPE.—Holotype, ♀ (genitalia on slide 8659), Marcapata, Peru, 4500 ft. (Rothschild Bequest); BM.

REMARKS.—Similar to *fumipennis* Dognin but differs from this species in some details of the wing markings. The costal streaks of the forewing are inclined distad, while in *fumipennis* their tips are turned sharply basad. The dorsal streaks of the forewing are more numerous and shaped quite differently from *fumipennis*. This also

concerns the spots of the internal portion of the forewing, which in the new species are arranged in distinctly longitudinal rows; in *fumipennis* these spots are less numerous, and their arrangement is more disorderly. The markings of the hindwing are quite different in the two species. In consequence of so many essential differences in the wing markings, it is difficult to assume that *fumipennis* and *ardoris* might belong together as two sexes of one species. Moreover, the types of both of them originate from localities rather remote one from the other. The new species also has some resemblance to *symplacota* Meyrick, but differs from the latter in the number and size of the wing spots, and has distinct genitalic structures requiring the placement of these two species in separate subgenera.

Pseudatteria (*Pseudatteria*) *cladodes* Walsingham

FIGURE 8; PLATE 14

Pseudatteria cladodes Walsingham, 1914, Biologia Centrali-Americana, Lepidoptera Heterocera, vol. 4, p. 269, pl. 8, fig. 6.

MALE GENITALIA.—Uncus rather narrow, slightly and gradually dilated toward rotundate apex with a minute, acute point, and on ventral surface with a little, haired papilla. Valva broadly subovate with external margin rounded; costa slightly sclerotized; sacculus slightly dilated at base and narrowly extended along entire ventral margin of valva. Aedeagus moderately long and thick, with a narrow distal process slightly dilated before tip, with spinulation laterobasad of this process, and more basad with a long, ventral keel directed basad and pointed at tip; cornutus large, transverse-subovate with a thick, obtuse, cuculliform distal process; a long, loop-shaped cuneus of numerous little spines, multiordinal in basal portion of loop, behind its middle, and on end, and uniordinal in intermediate portions.

FEMALE GENITALIA.—Sinus vaginalis flatly infundibular with a moderately broad lamella antevaginalis. Antrum tubular, slightly elongate, narrower than adjacent portion of cervical portion of corpus bursae; two lateral colliculi, one on each insignificantly incurved side of antrum. Cervix bursae striated, more densely caudad, with a strong lateral sclerotization; cestum long, narrow, tapering cephalad, surrounded by a weaker sclerotized, serrately outlined area. Corpus bursae moderately broad; signum indiscernible.

TYPE.—Holotype, female (genitalia on slide 5768), "Central America" (O. Salvin; Felder Collection; 400153); BM.

OTHER SPECIMENS EXAMINED.—♂ (without abdomen), paratype, Peru (Saunders Collection; 94–68); ♂ (genitalia slide 6615), Peru (Saunders; 401232); BM.

REMARKS.—The label of the holotype of *cladodes* reads "Central America," and Walsingham (1914) supposed that the specimen might

originate from Panama. Of the specimens examined by the present author, two others are labeled as originating from Peru. It seems therefore quite probable that some confusion has occurred in the labeling of the Walsingham specimen. Future records perhaps will bring more clarity to this problem.

Superficially *cladodes* might easily be mistaken for some form of the highly variable *volcanica* Butler; however, *cladodes* has 10 costal streaks of the forewing instead of 11 streaks as in *volcanica*, and there is a distinction in the genitalia of these two species. The male of *cladodes* has the uncus less narrowed basad, the valva is somewhat shorter and therefore looks relatively broader, the aedeagus has a ventral keel, and the cornutus and the cuneus are shaped differently. The female genitalia are rather similar in both *cladodes* and *volcanica*, but the antrum of the first species is less incurved laterally, and the signum is not discernible.

***Pseudatteria (Pseudatteria) leopardina* (Butler)**

PLATES 15, 16

Atteria leopardina Butler, 1872, Cistula Ent., vol. 1, p. 89; 1874, Lepidoptera Exotica, p. 178, pl. 61, fig. 5.

Pseudatteria leopardina.—Meyrick, 1912, *in* Wagner, Lepidopterorum catalogus, pt. 10, p. 16; 1913, *in* Wytsman, Genera insectorum, fasc. 149. p. 22.—Walsingham, 1914, Biologia Centrali-Americana, Lepidoptera Heterocera, vol. 4, p. 269, pl. 8, fig. 7.

MALE GENITALIA.—Uncus scaphiform-spatulate, dilated and rounded apically, at tip with a short, acute point directed ventrad, and a minute, setose papilla beneath this point. Valva subrectangular with a rounded external margin; sacculus dilated at base, and then narrowly extended along ventral margin of valva, not reaching external angle. Aedeagus thick but not stout, with a slight "waist" at middle, and a robust distal process; cornutus elongate with two apical points; no cuneus.

FEMALE GENITALIA.—Sinus vaginalis flatly infundibular; lamella antevaginalis narrow. Antrum tubular with two broad, lateral colliculi, one on each side; cervical portion of corpus bursae marmorate; cestum indiscernible; corpus bursae rather broad; signum divided by a transverse carina in two unequal portions, caudal one larger.

TYPE.—Holotype, female (genitalia on slide 5766), Costa Rica (75–17); BM.

OTHER SPECIMENS EXAMINED.—Costa Rica: ♀ (abdomen missing), no exact locality data; AMNH. ♀, same; USNM. 5 ♀♀, same (A. G. M. Gillot; Adams; Underwood); BM. ♂ (genitalia on slide, prepared by A. Busck on Sep. 28, 1920), and 2 ♀♀, Volcán de Poás,

Alajuela (W. Schaus); USNM. ♀, Rio Sixaola ("Saxola River"), Limón (W. Schaus); USNM. 2 ♀♀, Cachi ("Cache") district, Cartago; BM. 2 ♀♀, La Estrella, Cartago, July 1925, July 22, 1925; BM. ♂, and 7 ♀♀ (genitalia of one on slide, prepared by A. Busck on Mar. 20, 1926), Tuis, Cartago, 2400 ft.; 4000 ft., Sep. 2, 1908; and 5800 ft., Aug. 31, 1908 (W. Schaus); USNM. ♀, same locality, 6000 ft., Aug. 1888 ("A.B."; Meyrick Collection); BM. 7 ♀♀(genitalia of one on slide 6610), Volcán de Irazú, Cartago, 6000–7000 ft., no date, and 1915 (H. Rogers; nos. 66261 and 66262 among others); BM. ♀, Tres Ríos, Cartago, 5000 ft., December 1906 (W. Schaus); USNM. ♀, same data (W. Schaus; 5971); BM. 4 ♀♀, Orosi, Cartago, 1200 m. (A. H. Fassl); BM. ♀, same data; USNM. 2 ♀♀, Rio Sucio ("Susio"), San José (H. Rogers; 66262, 66265); BM. ♀, same data (H. Rogers; 66264); USNM. ♀, "San Gerónimo," [3] 1910 (W. Schaus); USNM. 5 ♀♀, Montes del Aguacate ("Mt. Aquacate") (Underwood; Rothschild Collection); BM. ♂ (genitalia on slide 8654), and ♀, Rio Cascajal ("Coscagal"), May 1919; BM. Panama: ♂ (genitalia slide 8656), and 8 ♀♀, Volcán de Chiriqui; no additional data (Rothschild Collection); 4000–6000 ft. (G. C. Champion; 66267-66269); 1899, 1915 (Meyrick Collection); BM. ♀, Bugaba, Chiriqui, 800–1500 ft. (G. C. Champion; 66266); BM. 3 ♀♀, Las Lagunas, Volcán de Chiriqui, Jan. 15, and 28, 1948 (R. E. Ellison); BM.

REMARKS.—An easily recognizable species. The variation is quite insignificant and consists of a slight change in the size and shape of separate spots. The terminal streaks of the forewing may be separate or fused in both sexes. On plate 15, figure 2, which shows the caudocephalic aspect of the male genitalia, the aedeagus is slightly misshaped because of the pressure of the cover-glass, and the "waist" of the aedeagus is barely seen.

Pseudatteria (*Pseudatteria*) *marmarantha* Meyrick

FIGURE 9; PLATES 17, 18

Pseudatteria marmarantha Meyrick, 1924, Exotic Microlepidoptera, vol. 3, p. 109.—Clarke, 1955, Catalogue of the type specimens of Microlepidoptera in the British Museum described by Edward Meyrick, vol. 1, p. 197; 1958, ibid, vol. 3, p. 199, pl. 99, figs. 1–1b.

MALE GENITALIA.—Uncus with a long, narrow stalk, and a rotundate, cupuliform apex ending with an acute spine directed ventrad. Valva broadly subovate; sacculus dilated at base. Aedeagus moderately thick with a narrow, spoonlike distal process; cornutus elon-

[3] There are two places with this name in Costa Rica: one at San Miguel, the other at Cañas.

gate, rather narrow with a pointed apical cap; cuneus composed of about 15 variously sized spines.

FEMALE GENITALIA.—Sinus vaginalis flatly infundibular; lamella antevaginalis moderately broad. Antrum rather short, tubular with two crescent, medially dilated, lateral colliculi; cervical portion of corpus bursae with narrow, parallel wrinkles V-shaped; caudal section of this portion with two lateral, sclerotized, tuberculate projections; cestum shaped as a long, narrow, longitudinally carinate plate of somewhat variable length. Corpus bursae moderately broad, slightly dilated caudad of middle portion; signum shaped as a moderate, transversely carinate plate slightly projected cephalad, or missing.

TYPES.—Lectotype, ♀ (genitalia slide 4414, JFGC), Rio Cauca, Colombia; BM. Lectoparatypes: 5 ♀♀, same locality, 1915; BM. ♀, same data; USNM.

OTHER SPECIMENS EXAMINED.—Colombia: ♀, 1912 (Meyrick Collection); BM. 3 ♀♀, no data (A. H. Fassl); USNM. 5 ♀♀, Rio Aguacatal, Cordillera Central, 2000 m. (A. H. Fassl); BM. ♀ Manizales, Caldas (A. M. Patino); BM. ♀ (genitalia slide 8687), Muzo, Boyaca, 400–800 m. (A. H. Fassl); BM. 2 ♀, "Corinto," Valle del Cauca, May–July; BM. ♀, "Quilichaya," Valle del Cauca, 6000 ft., March 1907 (Walsingham 6532); BM. ♀ (genitalia slide 4415, JFGC), Las Juntas ("Yuntas") near Cali, Valle del Cauca (Dognin Collection); USNM. ♀ (genitalia on slide 6611), 2 ♀♀, Cañon del Monte Tolima, Valle del Cauca, 4700 m. (A. H. Fassl); BM.

REMARKS.—The wing spots are somewhat variable in the size, shape, and number, but this changes very little the general appearance of the species, which is esaily recognizable because of the very characteristic markings of the wings. The spots in the subterminal area of the forewing have a tendency to become confluent with the terminal streaks. On the hindwing there are generally no spots in the interior area of the wing, but in some specimens these spots are even more numerous than in the male specimen figured in the present paper.

Pseudatteria (Pseudatteria) splendens (Druce)

FIGURE 10; PLATES 19–21, 41

Atteria splendens Druce, 1901, Ann. Mag. Nat. Hist., ser. 7, vol. 7, p. 440.

Atteria flabellata Meyrick, 1912, Trans. Ent. Soc. London, for 1911, p. 676.—Clarke, 1955, Catalogue of the type specimens of Microlepidoptera in the British Museum described by Edward Meyrick, vol. 1, p. 142.

Pseudatteria splendens.—Meyrick, 1912, *in* Wagner, Lepidopterorum catalogus, pt. 10, pl 16; 1913, *in* Wytsman, Genera insectorum, fasc. 149, p. 22.—Clarke, 1958, Catalogue of the type specimens of Microlepidoptera in the British Museum described by Edward Meyrick, vol. 3, p. 200, pl. 100, figs. 1–1c.

Pseudatteria flabellata.—Meyrick, 1912, *in* Wagner, Lepidopterorum catalogus, pt. 10, p. 16; 1913, *in* Wytsman, Genera insectorum, fasc. 149, p. 22, pl. 2, fig. 25; pl. 5, fig. 77.

MALE GENITALIA.—Uncus slender, scaphiform-spatulate, narrow at base and moderately dilated apically; tip rotundate with a small, setose papilla on ventral surface. Valva elongate, subrectangular with external margin broadly rounded; costa sclerotized at base; sacculus dilated at base, and narrowly extended along entire ventral margin of valva. Aedeagus moderately long and thick, with a narrow, spatulate, distal process, and with a spinulate area laterodistally; cornutus elongate, rather thick, bifurcate on tip, at base slightly dilated and laterally compressed; cuneus shaped as a long, curved chain of small spines, somewhat clustered disorderly in basal portion of chain, then uniordinally following one after another, and multiordinal in distal portion.

FEMALE GENITALIA.—Sinus vaginalis infundibular with a moderately broad lamella antevaginalis. Antrum tubular, slightly elongate, narrower than adjacent portion of cervix bursae; two lateral colliculi: cervical portion of corpus bursae striated, more densely caudally, and stronger sclerotized at right side; cestum long, rather narrow, tapering cephalad, and surrounded by a weaker sclerotized, serrately outlined area; corpus bursae long, moderately broad; signum elongate-scaphoid with scobination stronger laterad.

TYPES.—Lectotype of *splendens*, ♀ (genitalia on slide 4425, JFGC), Sarayacu, Napo Pastaza, Ecuador (C. Buckley); BM. Holotype of *flabellata*, ♀ (genitalia on slide 4423, JFGC), Ecuador, 1906 ("B."); BM.

OTHER SPECIMENS EXAMINED.—Colombia: ♀, no exact locality data; DEI. ♀, Florida, Rio Putumayo, April 1932 (G. Klug); BM. Ecuador: ♀, no exact locality data (Meyrick collection); BM. ♀ (genitalia on slide 66–Obr., 1963), no exact locality data (J. Arp); USMN. ♂ (genitalia on slide 6612), and 2 ♀♀, Sarayacu, Napo Pastaza (C. Buckley); BM. ♂, same data; USNM. Peru: ♀, Yurimaguas, Loreto (Parish; Meyrick Collection); BM. ♀, same locality; DEI. 2 ♀♀, Chambireyacú near Yurimaguas, Rio Huallaga, June–August 1885 (M. de Mathan); BM. ♂, Iquitos (Yquitos), Loreto, May 1932 (G. Klug); BM. 3 ♀♀, Rio Marañon, Loreto, 1913 (Meyrick Collection); BM. ♀, Rio Napo, Loreto, 1913 (Meyrick Collection); BM. ♂, Pebas, Loreto, "fin X^{bre} & 1^{er} Tr. 1880" (M. de Mathan); BM. Brazil: ♀, Saõ Paulo de Olivença ("Sao Paulo de Olivina"), Amazonas; VMNH. 2 ♀♀ (genitalia of one, slide 8681), Alcobaça, Rio Tocantins, Pará, April (A. H. Fassl); BM. 2 ♀♀, same data; USNM.

REMARKS.—A rather variable species, most similar to *chrysanthema* Meyrick, *igniflora* Meyrick, and the new species *tremewani* and *bradleyi* in the markings of the forewing. To judge from the examined materials, the most constant external character of *splendens* consists of two costal streaks in the outer half of the forewing (the third and the fourth streaks, counting from the wing apex). These streaks are always joined together with their tips, forming a figure similar to the inverted Greek letters π or γ; in a few cases this union is incomplete, but even then the tips of the above streaks are closely approximate to each other. This feature appears to be helpful for separation of *splendens* from most of the above-mentioned species, but it is insufficient for a separation of *splendens* and *chrysanthema* because of a similar arrangement of costal streaks in these two species. Nevertheless an experienced eye can find some distinction in the shape and arrangement of the terminal and tornal markings of the forewing, also in the markings of the hindwing of *splendens* and *chrysanthema*, but in dubious cases only the examination of the genitalia can be reliable.

The variation of the species shows itself in the additional development of some elements of the wing pattern, as well as in their reduction and/or division into smaller portions. Most striking are the two females from Brazil (pl. 41, figs. 5 and 6) which give the impression of being some separate species. A genitalic examination has proven their identity with *splendens*.

***Pseudatteria* (*Pseudatteria*) *volcanica* (Butler)**

FIGURE 11; PLATES 22–27, 41

A comparative study and the genitalic examination of the five forms (*volcanica* Butler, *mimica* Felder, *rivularis* Butler, *potamites* Walsingham, and *geminipuncta* Walsingham), described as separate species, give good reasons to consider them as being conspecific. On the basis of the superficial characters it becomes possible nevertheless to treat the specimens from South America and those from Central America as two separate subspecies, rather distinctly differentiated from each other. In some individuals this difference is seen perhaps less clearly than in others, but in general the separation of the two subspecies is not difficult.

MALE GENITALIA.—Uncus elongate-scaphiform, gradually dilated from a short stalk toward a rotundate tip ending with a little, acute point directed ventrad and accompanied by a small, setose papilla located basad of it. Valva elongate-ovate with external margin rounded; costa narrow, sclerotized; sacculus slightly thickened at base, and narrowly extended at least to middle of ventral edge of valva. Aedeagus moderately long and thick, with a narrow, slightly

undulate distal process tapering apicad; cornutus elongate, rather broad, ending with a distal cap with base much longer than height of cap and produced more to one side; a long, cordlike cuneus somewhat twisted in basal portion, and composed of numerous, minute thorns.

FEMALE GENITALIA.—Sinus vaginalis rather flatly infundibular with a narrow, transverse lamella antevaginalis. Antrum slightly sclerotized, subcylindrical, somewhat incurved laterally, about two times as long as broad; two arcuate, lateral colliculi, one on each side of antrum; cervical portion of corpus bursae longitudinally striated; cestum moderately long with a narrow, elevated, longitudinal carina and a serrately outlined area around it; corpus bursae elongate, rather broad; signum with a transverse carina separating a smooth, rotundate, caudal area from an angulate, cephalic area.

***Pseudatteria (Pseudatteria) volcanica volcanica* (Butler), new status**

PLATES 22, 23, 41

Atteria volcanica Butler, 1872, Cistula Ent., vol. 1, p. 90; 1874, Lepidoptera Exotica, p. 178, pl. 61, fig. 4.

Atteria mimica Felder, 1875, *in* Reise der Fregatte Novara, Zool., vol. 2, pt. 2, p. 3, pl. 139, fig. 42. [New synonymy.]

Pseudatteria volcanica.—Meyrick, 1912, *in* Wagner, Lepidopterorum catalogus, pt. 10, p. 16; 1913, *in* Wytsman, Genera insectorum, fasc. 149, p. 22.—Walsingham, 1914, Biologia Centrali-Americana, Lepidoptera Heterocera, vol. 4, p. 269.

Pseudatteria mimica.—Meyrick, 1912, op. cit., pt. 10, p. 16; 1913, op. cit., fasc. 149, p. 22.

Marginal streaks of forewing distinctly broader than white interspaces between them; penultimate costal streak reaches imaginary line drawn between tips of fourth costal streak (counting from wing apex) and upper tornal streak; orange area not or slightly distributed externad of this line. Apical spots of hindwing confluent into a large patch.

TYPES.—Holotype of *volcanica*, ♀ (genitalia slide 4409, JFGC), New Granada (14–17; according to original description: E. W. Janson); BM. Holotype of *mimica*, ♀ (genitalia slide 4411, JFGC), Bogotá, Colombia (Lindig; Felder Collection; 400163); BM.

OTHER SPECIMENS EXAMINED.—Colombia: ♀, Medellin, Antioquía (Gallego M.); USNM. 2 ♂♂ (genitalia of one, slide 8673), and 11 ♀♀ (genitalia of one, slide 8674), Caranche, Cundinamarca, "1er Sem." 1900, July–August 1903 (M. de Mathan); BM. 3 ♀♀, Bogota, Cundinamarca; BM. 5 ♀♀, Muzo, Boyacá, July–August 1903 (M. de Mathan), 400–800 m. (H. Fassl); BM. 3 ♀♀, same locality, Jan. 20 (Dognin Collection); USNM. 2 ♀♀, Villavicencio, Amazonas (Dognin

Collection); USNM. Peru: ♀, Oxapampa, Pasco, 2000 m. (Dognin Collection); USNM.

REMARKS.—The difference between the type specimens of *volcanica* Butler and *mimica* Felder is very minimal and merely consists of the confluence of three terminal streaks of the forewing and a somewhat distinct shape of the apical patch of the hindwing in *mimica*. These characters are rather inconstant and vary from specimen to specimen. In general, the subspecies *volcanica* seems to be less variable than the subspecies *rivularis*, and no forms with the streaks of the forewing widely reduced or confluent as described in the latter subspecies are known for the subspecies *volcanica*.

***Pseudatteria (Pseudatteria) volcanica rivularis* (Butler), new status**

FIGURE 11; PLATES 24–27

Atteria rivularis Butler, 1875, Ann. Mag. Nat. Hist., ser. 4, vol. 15, p. 342.

Pseudatteria rivularis.—Meyrick, 1912, *in* Wagner, Lepidopterorum catalogus, pt. 10, p. 16; 1913, *in* Wytsman, Genera insectorum, fasc. 149, p. 22.—Walsingham, 1914, Biologia Centrali-Americana, Lepidoptera Heterocera, vol. 4, p. 269, pl. 8, fig. 3.—Busck, 1931, Bull. Brooklyn Ent. Soc., vol. 26, p. 210, pl. 11, fig. 15.

Pseudatteria potamites Walsingham, 1913, Biologia Centrali-Americana, Lepidoptera Heterocera, vol. 4, p. 214; 1914, op. cit., vol. 4, p. 267, 268, pl. 8, fig. 4. [New synonymy.]

Pseudatteria geminipuncta Walsingham, 1914, op. cit., vol. 4, p. 268, pl. 8, fig. 5. [New synonymy.]

Marginal streaks of forewing narrow, generally almost as broad as white interspaces between them, or slightly broader; penultimate costal streak not reaching imaginary line drawn between tips of fourth costal streak (counting from wing apex) and upper tornal streak; orange area distributed rather far externad of this line. Apical spots of hindwing more or less separate from each other.

TYPES.—*P. rivularis:* Lectotype, ♀ (genitalia slide 4410, JFGC), Veraguas ("Veragua"), Panama ("75–28"); ♀ lectoparatype, same locality ("75–28"); BM. *P. potamites:* Lectotype, ♂ (genitalia slide 4407, JFGC), Jalapa, Veracruz, Mexico, 4500 ft., 1887 (W. Schaus; 4601); lectallotype, female (genitalia slide 4408, JFGC), same data (4602); BM. ♀ lectoparatype, same locality (5964); USNM. ♀ lectoparatype, Orizaba, Veracruz, Mexico (W. Schaus; 5963); BM. One female lectoparatype, same locality, February 1908 (R. Muller); USNM. One female lectoparatype, Misantla, Veracruz, Mexico (W. Schaus; 5965); ♀ lectoparatype, El Zapote, Escuintla, Guatemala (G. C. Champion; 66229); USNM. ♀ lectoparatype, Juan Viñas, Cartago, Costa Rica, 2500–3500 ft., November 1906 (W. Schaus; 5968); BM. *P. geminipuncta:* Holotype,

♀ (genitalia slide 5772), Panama (Saunders Collection; "94–68"); BM.

OTHER SPECIMENS EXAMINED.—Central America: ♀ (Felder Collection; 400152); BM. Mexico: ♂, no locality data; USNM. ♂ (genitalia on slide 8671), and ♀ (W. Schaus, and Paravicini Collection); BM. 3 ♀♀ (genitalia of one, slide 8672), Jalapa, Veracruz (Höge; 66227), and 4500 ft., 1887 (G. C. Champion; 4603, 4604); BM. ♂ (genitalia of one, slide 4412, JFGC), and 7 ♀♀ (genitalia of one, slide 4413, JFGC), same locality; USNM. 2 ♂♂ (genitalia of one on slide, prepared by A. Busck on Sept. 4, 1919), Orizaba, Veracruz (W. Schaus); USNM. ♀, Misantla, Veracruz (M. Trujillo; 66228); BM. ♀, Coatepec, Veracruz (Brooks; 66226); BM. ♂ (genitalia slide 6617), San Andrés Tuxtla ("S. Andres"), Veracruz, April 1914; BM. ♀ (genitalia slide 4408, JFGC), Veracruz, 1887 (W. Schaus; only the slide located); USNM. Guatemala: 4 ♀♀, no locality data; USNM. ♀, no locality data, 1930 (Meyrick Collection); BM. ♀, "Vera Paz," 1915 ("C.C."); BM. 3 ♂♂ (genitalia of one on slide, prepared by A. Busck on Dec. 4, 1928), and 4 ♀♀ "Cayuga," Mar., May, Sept., and Oct. (Schaus and Barnes Collection); USNM. ♀ (genitalia on slide, prepared by A. Busck on Mar. 11, 1926), Tactic, Alta Verapaz, July (Schaus and Barnes Collection); USNM. 3 ♀♀ Gubilquitz, Alta Verapaz, 1050 ft., 1880 (G. C. Champion; 66235, 66236, 66241); BM. ♂ (genitalia slide 6616), and ♀, Senahú, Alta Verapaz, 2800 ft., November 1879 (G. C. Champion); BM. ♂, Panzós, Alto Verapaz (G. C. Champion; 66240); BM. ♀ (abdomen missing), Tucurú, Alta Verapaz, May 1917; BM. 4 ♀♀, Purulá, Baja Verapaz (Schaus and Barnes Collection); USNM. ♀, same locality (G. C. Champion; 66232); BM. ♂ (genitalia on slide, prepared by A. Busck on Feb. 14, 1929), and 4 ♀♀, Volcán de Santa Maria, Quezaltenango, Apr., June, and Oct. (Schaus and Barnes collection); USNM. ♀, Las Mercedes, Quezaltenango, 3000 ft., 1881 (G. C. Champion); USNM. ♀, same data (G. C. Champion; 66242); BM. ♀, El Tumbador ("El Zumbador"), San Marcos, 2500 ft. (G. C. Champion; 66238); BM. ♀, San Isidro, Suchitepéquez, 1600 ft., 1880 (G. C. Champion; 66239); BM. 2 ♀♀, Capetillo, Sacatepéquez (G. C. Champion; 66233, 66234); BM. 7 ♀♀, El Zapote, Escuintla, 2000 ft., 1879 (G. C. Champion; Walsingham, and Meyrick Collections; among them nos. 66230, and 66231); BM. ♀, Palín, Escuintla, July (Schaus and Barnes Collection); USNM. British Honduras: ♀, no locality data; BM. ♀, Rio Grande, 1932 (J. J. White); BM. 2 ♀♀, Rio Sarstun ("Sarstoon") (Blancanen; 66243, 66244); BM. Honduras: ♀, no locality data (J. Lienhart; Meyrick Collection); BM. ♀, "La Cambre" (= ?La Cumbre), 3000 ft., June 1922 (J. Lienhart; Meyrick Collection); BM. 4 ♀♀, San Pedro Sula, Cortés,

1896 (E. Wittkugel), and 4200 ft., June 1922 (J. Lienhart; Meyrick Collection); BM. Nicaragua: ♀ (genitalia slide 705–Obr.), "Western Nicaragua," March ?, 1917; AMNH. ♂ (genitalia slide 635–Obr.), Matagalpa, June 28, 1953; AMNH. ♀, "Concordia Cafétal," Jinotega, 4400 ft., March 1906 (M. G. Palmer); BM. Costa Rica: 11 ♀♀ (two of them without abdomina), no locality data (Underwood; A. G. M. Gillott), and ".15" (V. P.; Meyrick Collection); BM. ♀, Rio Cascajal, Alahuela, January 1924 (Janson); BM. ♀ (abdomen missing), Rio Reventazón, March 1923; BM. ♂ (genitalia on slide 6618), Volcán de Irazú, Cartago, 6000–7000 ft., (Rogers; 66260); BM. 2 ♀♀, Orosi, Cartago, 1200 ft. (A. H. Fassl); BM. 3 ♀♀, Juan Viñas, Cartago; no date; 4000 ft., Aug. 24, 1908; and 2500–3500 feet, November 1906 (W. Schaus); USNM. 16 ♀♀, Cachi, Cartago (H. Rogers; 66245–66250, 66252–66258, and others); BM. 4 ♀♀, same locality (W. Schaus; H. Rogers); USNM. 9 ♀♀ (genitalia of one on slide prepared by A. Busck on Mar. 10, 1926), Tuis, Cartago; no date; 2400 ft.; and 2400 ft., July 1907 (W. Schaus); USNM. 2 ♀♀, "La Florida" (= ? La Flor, Cartago), 5000 ft. (W. Schaus); USNM. Panama: ♀, no locality data (Saunders Collection); BM.[4] ♂ "Cerro Campana," Dec. 29, 1946 (R. E. Ellison); BM.

REMARKS.—The nominate form of this subspecies has the apical streak of the forewing continued to the upper of the tornal streaks and connected to it. The specimens without this connection received the name *potamites* Walsingham. They have the terminal streaks of the forewing narrow, and some rotundate spots located internad of streaks. The name *geminipucta* Walsingham was given to an undoubtedly aberrative, narrow-winged female specimen representing an extreme of the form *potamites*. All these forms intergrade with each other, and thus hardly deserve separate names. Even Walsingham himself, the author of *potamites*, was probably not quite certain of the characters distinguishing it, and identified some paratypes of this "species" in the collection of the U.S. National Museum (nos. 5962, 5964, and 66229) as being *rivularis*. The photographs in the present paper give an idea of the variation of the subspecies in Central America and, besides the intergrading specimens, also include some forms slightly deviating from the average limits of this variation.

***Pseudatteria (Pseudatteria) bradleyi*, new species**

PLATE 28

FEMALE.—Antenna black with scattered, whitish scales on scapus. Labial palpus black with cream-white color starting at base laterally

[4] One other female specimen in the British Museum (Natural History), labeled "Panama Crowley," belongs to the subspecies *volcanica* and probably originates from South America.

and turning on inner surface to middle of second segment. Head cream white with a median, black stripe expanded on vertex. Thorax black with some cream-white spots posteriorly and laterally; patagia cream white, black at middle; tegula black, along external margin and on apex cream white. Abdomen orange. Forewing deep reddish orange, in subcostal area and external third of wing cream white; blue-black markings: nine costal streaks; two external streaks confluent with themselves and a long, apical streak, forming a trifurcate spot; a large, bifurcate spot on termen, confluent with a rotundate, tornal spot; a separate, rotundate spot at border of orange and cream-white areas between tornal spot and seventh costal streak (counting from wing base); cilia concolorous with marginal markings, blue black in front of spots touching termen, and cream white in interspaces. Length of forewing 14 mm. Hindwing deep reddish orange with violet-black marginal spots: a large spot at wing apex, confluent with a smaller terminal spot beneath; two smaller, separate spots at tornus; cilia cream white at apex, between apical and terminal spots, and between terminal and tornal spots; in front of spots cilia concolorous with them, in remaining portions orange.

MALE.—Unknown.

FEMALE GENITALIA.—Sinus vaginalis rotundate-infundibular with lamella antevaginalis laterally dilated, at middle narrowed for a short distance. Antrum widely tubular, slightly narrowed caudally, and with cephalic margin scalloped; two narrow, lateral colliculi; cervical portion of corpus bursae striated, with a dense sclerotization near linear cestum, latter slightly protruding this sclerotized area; corpus bursae moderately broad; signum with an arcuate, transverse carina, a weakly sclerotized area caudally, and a serrate, triangular area cephalically.

TYPE.—Holotype, ♀ (genitalia slide 8679), Las Yungas, La Paz, Bolivia, 1000 m., Oct. 29, 1908 (Seebold; 16476); BM. The exact date and the altitude were established on the basis of information by H. Rebel, found in the catalogue of the Walsingham Collection.

REMARKS.—Very similar in the markings of the wings to *igniflora* Meyrick. Differs from this slightly variable species in having some scattered, whitish scales on the scapus of the antenna, the inner surface of the second segment of the labial palpus cream white only to its middle, the patagia interrupted at the middle by black, the terminal and the tornal spots of the forewing connate, the latter spot rotundate, the apical spot of the hindwing smaller, and the genitalia distinct in their details. The genitalic differences consist mainly of the sinus vaginalis being less wide and more rotundate, the narrow middle portion of the lamella antevaginalis much shorter, the antrum somewhat longer and slightly narrowed caudally, its cephalic margin being dis-

tinctly scalloped, both of the colliculi narrow, and the signum shaped differently. The cestum is similar to that in *igniflora*, but does not reach as far cephalad, being almost hidden in the sclerotization of the cervix portion of the bursa copulatrix. This sclerotization is distinctly striated in the new species; in *igniflora* it is rather marmorated.

The species is named for J. D. Bradley of the British Museum (Natural History), whose kind assistance and steady attention to the present author's research have contributed much to the completeness of the present paper.

Pseudatteria (*Pseudatteria*) *igniflora* Meyrick

PLATES 29, 30

Pseudatteria igniflora Meyrick, 1930, Exotic Microlepidoptera, vol. 3, p. 606.—Clarke, 1955, Catalogue of the type specimens of Microlepidoptera in the British Museum described by Edward Meyrick, vol. 1, p. 167; 1958, op. cit., vol. 3, p. 196, pl. 98, figs. 3–3c.

FEMALE GENITALIA.—Sinus vaginalis very flatly infundibular with lamella antevaginalis narrow at middle and dilated laterally. Antrum tubular, rather short, caudally slightly narrower than cephalically; two lateral colliculi, right one distinctly broader; cervical portion of corpus bursae caudally almost as broad as antrum, cephalically more or less dilated, striated, and sometimes with spots between lines, looking somewhat marmorate; caudal margin of cervical portion more or less scalloped, caudolaterally sometimes with sclerotized areas; cestum more or less long with a longitudinal carina; corpus bursae long, rather broad; signum with a transverse fold and two rather smooth, weakly sclerotized areas somewhat narrowed to their ends and located caudad and cephalad of fold.

TYPE.—Holotype, ♀ (genitalia slide 4424, JFGC), Bolivia (ex Germain); BM.

OTHER SPECIMENS EXAMINED.—Bolivia: ♀ (genitalia slide 4532, JFGC), no exact data (ex Germain); USNM. ♀ (genitalia slide M. 1030), Chapare, 400 m., June 1951 (R. Zischke); ZSM.

REMARKS.—The species was established on the basis of a single female specimen; the male is unknown. The two females, additionally examined by the present author, differ slightly from the type. In one of these females (Chapare; slide M. 1030) there is a narrow, additional costal streak on the forewing between the fourth and fifth main streaks; on the left forewing the terminal spot is joined to the tornal spot, and on each hindwing there are two tornal spots below the large terminal spot. These characters make this female somewhat similar to *bradleyi*, new species, but in the latter the corpus bursae is distinctly shorter, and the lamella antevaginalis, antrum, and cestum have

other shapes. In the other female of *igniflora* ("Bolivia"; slide 4532) the preapical spot of the forewing includes only one cream-white costal mark, and is narrower connected with the internal, rounded extension of the apical spot. The latter and the terminal spot below it each includes only one cream-white marginal mark. The tornal spot has no cream-white mark on the dorsum or anywhere. The apical spot of the hindwing is less extended internad than in the type of *igniflora*, and has a rather long, cream-white mark at the wing apex. All interspaces between the terminal and tornal spots are reddish orange; in the type of *igniflora* the interspace between the terminal spot and the upper of the tornal spots is cream white. The genitalia of this female also are distinct from those of *bradleyi*, and differ somewhat from those of the type specimen and the female specimen of *igniflora* which has been discussed previously. It is quite possible that in Bolivia there are more than one species similar to *igniflora*, and the specimen from "Bolivia" (slide 4532) belongs to a new species.

Subgenus *Eurynatteria*, new subgenus

Atteria (in part).—Druce, 1901, Ann. Mag. Nat. Hist., ser. 7, vol. 7, p. 439.—Dognin, 1904, Ann. Soc. Ent. Belgique, vol. 48, p. 132.—Meyrick, 1909, Trans. Ent. Soc. London, p. 14.—Dognin, 1912, Hétérocères nouveaux de l'Amérique du Sud, fasc. 6, p. 51.

Pseudatteria (in part).—Meyrick, 1912, *in* Wagner, Lepidopterorum catalogus, pt. 10, p. 16; 1913, *in* Wytsman, Genera insectorum, fasc. 149, p. 22; 1917, Trans. Ent. Soc. London, p. 6; 1924, Exotic Microlepidoptera, vol. 3, pp. 108, 109; 1936, Arb. Morph. Taxon. Ent. Berlin, vol. 3, p. 104.—Clarke, 1958, Catalogue of the type specimens of Microlepidoptera in the British Museum described by Edward Meyrick, vol. 3, pp. 195, 196.

TYPE SPECIES.—*Atteria heliocausta* Dognin, 1912.

MALE.—Uncus broadly spatulate, widely dilated apically. Vesica with a single, robust cornutus; no cuneus.

FEMALE.—Antrum as broad as sinus vaginalis; no lateral colliculi. Cervix bursae with strong thorns caudally, without striation cephalically.

The name *Euryn* (+*Atteria*, the name of a tortricid genus) is derived from the Greek *ευρύς*, meaning wide or broad.

Pseudatteria (*Eurynatteria*) *dictyanthes* Meyrick

PLATE 31

Pseudatteria dictyanthes Meyrick, 1936, Arb. Morph. Taxon. Ent. Berlin, vol. 3, p. 104.—Clarke, 1955, Catalogue of the type specimens of Microlepidoptera in the British Museum described by Edward Meyrick, vol. 1, p. 116.

FEMALE GENITALIA.—Sinus vaginalis with a narrow, almost linear lamella antevaginalis. Antrum slightly narrower than adjacent

portion of corpus bursae; many strong, rather long thorns in and before caudal section of cervical portion of corpus bursae; caudal half of corpus bursae slightly sclerotized and decorated with some stronger sclerotized, longitudinal folds; corpus bursae elongate, rather broad, rounded cephalically; signum shaped as an irregular, scobinate plate.

TYPE.—Holotype, ♀, Ecuador; DEI.

REMARK.—The species is known only from its holotype.

Pseudatteria (Eurynatteria) buckleyi (Druce)

PLATES 32, 33

Atteria buckleyi Druce, 1901, Ann. Mag. Nat. Hist., ser. 7, vol. 7, p. 439.

Atteria purpurea Dognin, 1904, Ann. Soc. Ent. Belgique, vol. 48, p. 132. [New synonymy.]

Pseudatteria buckleyi.—Meyrick, 1912, *in* Wagner, Lepidopterorum catalogus, pt. 10, p. 16; 1913, *in* Wytsman, Genera insectorum, fasc. 149, p. 22.

Pseudatteria purpurea.—Meyrick, 1912, *in* Wagner, Lepidopterorum catalogus pt. 10, p. 16; 1913, *in* Wytsman, Genera insectorum, fasc. 149, p. 22.

MALE GENITALIA.—Uncus spatulate, obtriangular, narrow at base, and widely dilated and rounded distally. Valva subrectangular with external margin rounded; costa sclerotized, and with a dentate harpe. Aedeagus thick with a broad, apical process; cornutus long, dilated in basal portion, and narrowly tapering in distal portion.

FEMALE GENITALIA.—Sinus vaginalis with a lamella antevaginalis narrow at middle and dilated laterally. Antrum scobinate cephalically; thorns in cervical area moderately long; caudal half of corpus bursae distinctly sclerotized; corpus bursae broad, cephalically rounded; signum shaped as a plate with serrated outline, and cephalically with an elevated carina.

TYPES.—Holotype of *buckleyi*, ♂ (genitalia slide 5769), Intag ("Intaj"), Ecuador (C. Buckley; 6609); BM. Holotype of *purpurea*, ♀ (genitalia missing), Loja vicinity, Ecuador, 1893 (Dognin); USNM.

OTHER SPECIMENS EXAMINED.—Ecuador ♂, and 3 ♀♀ (genitalia of one, slide 6625), Chiguinda (C. Buckley); BM. ♂, Sarayacu (C. Buckley); BM.

REMARKS.—In compliance with the labels in the collection of the British Museum (Natural History), J. Durrant supposed that *buckleyi* and *purpurea* might merely be the two sexes of one species. The present author approves this point of view and finds especially convincing the fact that the markings of the forewing are very similar in both *buckleyi* and *purpurea*. The differences in the markings of the hindwing may be explained by sexual dimorphism, already observed in two other species of the same subgenus *Eurynatteria*. Thus, in the males of *cantharopa* Meyrick these markings also are more developed and confluent, while in the females they consist

of separate spots. In the females of *heliocausta* Dognin the markings of the hindwing are somewhat more scanty than in the males, and only in the form *baccheutis* Meyrick of this species is the difference less striking, because of the development of additional spots. A careful comparison of the male specimens of *buckleyi* and the female specimens of *purpurea* permits recognition of common elements in the markings of the hindwing. This is particularly convincing in the specimens of both sexes, collected in the same locality (Chiguinda).

The abdomen of the holotype of *purpurea* had been badly damaged, probably at the time the specimen was caught or shortly after, and the genitalia became lost. For this reason it has become necessary to examine and photograph the female genitalia of a specimen other than the holotype, but superficially similar to it.

Pseudatteria (Eurynatteria) cantharopa (Meyrick)

PLATES 34–36

The holotype of this species is a female with the abdomen missing. The present author had the chance to examine two more female specimens originating from the same locality as the holotype (Chulumani, Bolivia) and well matching the latter. Moreover, he had at hand six more specimens from Peru, similar to those from Bolivia, but nevertheless distinct from them in some external characters, constant in all of the examined specimens. The female genitalia give no grounds for separation of the Peruvian moths as a species distinct from *cantharopa*, but the external appearance permits treating them at least as a subspecies.

Pseudatteria (Eurynatteria) cantharopa cantharopa (Meyrick), new status

PLATE 34

Atteria cantharopa Meyrick, 1909, Trans. Ent. Soc. London, p. 14.—Clarke, 1955, Catalogue of the type specimens of Microlepidoptera in the British Museum described by Edward Meyrick, vol. 1, p. 73.

Pseudatteria cantharopa.—Meyrick, 1912, *in* Wagner, Lepidopterorum catalogus, pt. 10, p. 16; 1913 *in* Wytsman, Genera insectorum, fasc. 149, p. 22.—Clarke, 1958, Catalogue of the type specimens of Microlepidoptera in the British Museum described by Edward Meyrick, vol. 3, p. 195, pl. 97, fig. 2.

FEMALE.—Antenna black. Labial palpus with terminal segment and outer surface of second segment black; basal segment, inner surface and dorsal edge of second segment greenish black. Head orange with a median black stripe expanded on vertex. Thorax and tegula deep bluish black; patagia, base and fringes of tegula, two anterior, three median, and two posterior spots on thorax orange. Abdomen

copper brown, sometimes with bluish-green reflection. Forewing orange; two broad, transverse, prismatic bluish-green bands, crossing wing from costa to dorsum, one at middle of wing, other between middle band and base of wing; a large, concolorous, irregularly ovate spot externad of middle band, and remote from all wing margins; mentioned bands and spot outlined with black; a moderate, black costal spot near base of wing; three smaller, concolorous spots along basal portion of dorsum; two black, rather small spots in interspace of transverse bands, one on costa, another below it, and an obliterate spot on dorsum in same interspace; four black spots in external portion of costa, one spot on wing apex, three on termen, and two or three on tornus; cilia concolorous with adjacent portions of wing. Length of forewing 14 mm. Hindwing orange with brownish-black markings consisting of two large spots on costa, two or three almost equally large spots on disc, one small spot on wing apex, four equally sized spots on termen, two large spots on tornus; dorsal area of wing broadly black; cilia concolorous with adjacent portions of wing.

TYPE.—Holotype, ♀ (abdomen missing), Chulumani, Bolivia, December 1906, 6500 ft. ("S."); BM.

OTHER SPECIMENS EXAMINED.—2 ♀♀ (genitalia of one on slide M.1011), Yungas, Chulumani, Bolivia, 1500–2000 m. (Schulze); ZSM.

REMARKS.—The male of this subspecies is unknown; the female genitalia as in subspecies *pulchra*.

***Pseudatteria (Eurynatteria) cantharopa pulchra*, new subspecies**

PLATES 35, 36.

Similar to subspecies *cantharopa*, but without black dots in interspace of transverse bands of forewing. Length of forewing 15–16 mm. Hindwing of female as in *cantharopa*, but with spots on disc more or less confluent with costal spots; interspaces of marginal spots more or less darkened with brown; in male brown dorsal area of hindwing widely distributed over disc, and marginal spots more or less confluent with themselves; cilia of hindwing brown in both sexes.

MALE GENITALIA.—Uncus subcordate on a short stalk. Valva oblong with external margin rotundate; costa with a short, angulate harpe at about middle; sacculus rather cylindrical at base, then narrowly extended along ventral margin of (folded) valva. Aedeagus thick with a rotundate coecum penis; a single, large cornutus broad in basal portion and with a long, tapering distal process.

FEMALE GENITALIA.—Sinus vaginalis with a narrow lamella antevaginalis roundly dilated laterally. Antrum cephalically encircled by a rather broad area of cervical portion of corpus bursae covered

with strong, numerous thorns; cervical portion of corpus bursae membranous, broader than corpus itself; a broad, sclerotized girdle located cephalad of cervical portion, and surrounded by small, sclerotized dots, in part confluent among themselves; corpus bursae broad, rounded on fundus; signum shaped as a scobinate, slightly folded plate.

TYPES.—Holotype, ♂ (genitalia slide 99–Obr., 1964), Chachapoyas, Dept. Amazonas, Peru, 1889 (M. de Mathan); allotype, ♀ (genitalia slide 100–Obr., 1964), Peru (M. de Mathan); USNM. 67565 Paratypes: ♂, Peru (M. de Mathan); ♂ (genitalia slide 6623), 2 ♀♀ (genitalia of one slide 6624), Chachapoyas, Dept. Amazonas, Peru, 1889 (M. de Mathan); BM.

***Pseudatteria (Eurynatteria) heliocausta* (Dognin)**

PLATES 37–39.

Atteria heliocausta Dognin, 1912, Hétérocères nouveaux de lAmérique du Sud, fasc. 6, p. 51.

Pseudatteria fornicata Meyrick, 1917, Trans. Ent. Soc. London, p. 6.—Clarke, 1955, Catalogue of the type specimens of Microlepidoptera in the British Museum described by Edward Meyrick, vol. 1, p. 143.

Pseudatteria metacapna Meyrick, 1924, Exotic Microlepidoptera, vol. 3, p. 108.—Clarke, 1955, op. cit., vol. 1, p. 204.

Pseudatteria heliocausta.—Clarke, 1958, Catalogue of the type specimens of Microlepidoptera in the British Museum described by Edward Meyrick, vol. 3, p. 196, pl. 98, figs. 1–1c, 2–2c.

MALE GENITALIA.—Uncus broad, subcordate with a short stalk. Valva oblong, rotundate externally; costa with a rotundate-triangular harpe before middle; sacculus thickened at base, then narrowly extended along ventral margin of (folded) valva. Aedeagus moderately thick with a rotundate apical projection; cornutus strong, corniform, narrow and tapering distad, dilated basad.

FEMALE GENITALIA.—Sinus vaginalis with a rather broad lamella antevaginalis roundly dilated laterally. Antrum covered cephalically by caudal margin of cervical portion of corpus bursae with many thorns; a sclerotized, mosaic area at right side of caudal section of corpus bursae; latter broad; signum shaped as a plate with a narrow, scobinate margin not closed caudally, often with a narrow, oblique carina, and somewhat variable in form.

TYPES.—Lectotype of *heliocausta*, ♂ (genitalia slide 2-Obr., Feb. 24, 1961), San Antonio, District Cali, Columbia, 2000 m., Sep. 22, 1908 (A. H. Fassl); ♂ lectoparatype (genitalia slide prepared by A. Busck, Apr. 4, 1926), same data; USNM. Lectotype of *fornicata*, ♀ (genitalia slide 4420, JFGC), San Antonio, District Cali, Colombia, 5800 ft., November 1907 ("R."); BM. ♀ lectoparatype of *fornicata* (genitalia slide 4431, JFGC), same locality; USNM. Lectotype of *metacapna*, ♀ (genitalia slide 4421, JFGC), San Antonio, District Cali,

Colombia, 8000 ft., January 1909; lectallotype, ♂ (genitalia slide 4422, JFGC), same data; BM.

OTHER SPECIMENS EXAMINED.—Colombia: 2 ♀♀, Bogotá, Cundinamarca (Child); BM. ♂, "Mt. Socorro," 12,500 ft., 1920 (Meyrick Collection); BM. 4 ♂♂ (genitalia of one, slide 6613) and 6 ♀♀, Rio Aguacatal, W. Cordillera, 2000 m. (A. H. Fassl); BM. ♂ and 2 ♀♀ (genitalia slides 4432–4434, JFGC), same data; USNM. ♂, ♀, San Antonio, District Cali, 240 m. (A. H. Fassl); BM. ♂ (genitalia slide 630-Obr.), District Cali, 6500 ft., Jan. 24, 1935; AMNH. ♀, Cañon del Monte Tolima, Valle del Cauca. 1300 m. (A. H. Fassl); BM.

REMARKS.—Somewhat similar to *symplacota* Meyrick and with a cornutus almost of the same shape. Differs in having the genitalic characters of the subgenus *Eurynatteria* and in some details of the markings of the wings. The latter vary a little in the confluence of the apical and terminal streaks of the forewing and the development of spots in the internal areas of both wings; the extreme form with numerous discal spots received a separate name *baccheutis* Meyrick. The hindwing of male is suffused with yellowish olive and usually has the subdorsal spots larger and more numerous.

***Pseudatteria* (*Eurynatteria*) *heliocausta* (Dognin) form *baccheutis* Meyrick, new status**

PLATES 40, 41

Pseudatteria baccheutis Meyrick, 1924, Exotic Microlepidoptera, vol. 3, p. 109.—Clarke, 1955, Catalogue of the type specimens of Microlepidoptera in the British Museum described by Edward Meyrick, vol. 1, p. 62; 1958, op. cit., vol. 3, p. 195, pl. 97, figs. 1–1c.

FEMALE GENITALIA.—As in the nominate form of *heliocausta*.

TYPE.—Lectotype, ♀ (genitalia slide 4437, JFGC), Volcán de Miravalles, Guanacaste and Alajuela, Costa Rica, 1895 ("U."); BM.

OTHER SPECIMENS EXAMINED.—*Costa Rica:* ♀ (genitalia slide 4438, JFGC), no exact data, 1906 ("U."); BM. ♀ (genitalia on slide), "La Caja," 8 km. west of San José, 1930 (Schmidt); DEI.

Remarks.—Meyrick described *baccheutis* as a separate species on the basis of two specimens, one of which was the present lectotype, and the other a male which is now missing. The photographs in plate 40 give a clear idea of *baccheutis* as a form very close to *heliocausta*. The only important difference between them is in the discal and dorsal spots, well developed in *baccheutis* and only slightly (and not always) indicated in *heliocausta*. The discal dots of the hindwing show a similar arrangement in both, although they also are better developed and more numerous in *baccheutis*. There is no difference in the female genitalia of both, and this is the reason for treating *baccheutis* and *heliocausta* as conspecific. It is quite possible that *baccheutis*, originat-

ing from a rather widely remote locality, might be a geographical subspecies of *heliocausta*, but this cannot be proven until more material is available.

Subgenus *Sphaeratteria*, new subgenus

Pseudatteria (in part).—Meyrick, 1930, Exotic Microlepidoptera, vol. 3, p. 606; 1932, *op. cit.*, vol. 4, p. 254.—Clarke, 1958, Catalogue of the type specimens of Microlepidoptera in the British Museum described by Edward Meyrick, vol. 3, pp. 195, 200.

TYPE SPECIES.—*Pseudatteria symplacota* Meyrick, 1930.

MALE.—Uncus with a ventral, transverse carina in slightly dilated basal portion; terminal portion of uncus equally broad. Vesica with a single, robust cornutus; no cuneus.

FEMALE.—Antrum and cervical portion of corpus bursae fused together, forming a globular dilatation as broad as sinus vaginalis; cephalic section of this globe densely covered with thorns.

The name *Sphaer* (+*atteria*, the name of a tortricid genus) is derived from the Greek *σφαιρα*, meaning a ball or a sphere.

Pseudatteria (Sphaeratteria) symplacota Meyrick

PLATES 42, 43

Pseudatteria symplacota Meyrick, 1930, Exotic Microlepidoptera, vol. 3, p. 606.—Clarke, 1955, Catalogue of the type specimens of Microlepidoptera in the British Museum described by Edward Meyrick, vol. 1, p. 300; 1958, *op. cit.*, vol. 3, p. 200, pl. 100, figs. 1–1c, 3–3c.

Pseudatteria anemonantha Meyrick, 1932, Exotic Microlepidoptera, vol. 4, p. 254.—Clarke, 1955, Catalogue of the type specimens of Microlepidoptera in the British Museum described by Edward Meyrick, vol. 1, p. 46; 1958, op. cit., vol. 3, p. 195.

MALE GENITALIA.—Uncus moderately broad, spatulate; at base slightly dilated, and bearing a small, foldlike, transverse carina on ventral side. Valva subrectangular with external margin almost vertical, slightly convex; costa sclerotized, simple; sacculus slightly thickened at base, then narrow. Aedeagus moderately thick; a single, large, strong cornutus, bent slightly distad of middle; distal portion of aedeagus tapering and ending acutely, basal portion broader and longer.

FEMALE GENITALIA.—Sinus vaginalis with a narrow lamella antevaginalis. Antrum and cervical portion of corpus bursae fused together and forming a globular body covered cephalically with dense thorns; cestum short, almost linear; corpus bursae moderately long, broad, cephalically rotundate; signum a moderate platelet with a stronger, horseshoe-shaped, rather broad, spinulate emargination.

TYPES.—Holotype of *symplacota*, ♀ (genitalia on slide 4427, JFGC), Balzapamba, Bolivar, Ecuador, between November 1893 and February 1894 (M. de Mathan); BM. Holotype of *anemonantha*, ♀, Marcapata, Peru; DEI.

OTHER SPECIMENS EXAMINED.—Peru: ♀, no exact data; DEI. ♀ (genitalia slide 4530, JFGC), "pseudotype" of *anemonantha*, Marcapata, 1934 ("H."; Meyrick Collection); BM. ♀, same locality, 4500 ft.; BM. ♀, La Merced, Junin, 2000–3000 ft. (Walkins; 6606); BM. ♀, Rio Chanchosmayo ("Chanchamayo") (A. M. Moss); BM. Bolivia: ♂ (genitalia on slide 6614), Las Yungas, La Paz (16477); BM. 4 ♀♀, same locality, 1908 (Seebold; 16479–16482); BM. ♂ (genitalia on slide 5–Obr., Feb. 24, 1961), and ♀ (genitalia slide 4430, JFGC), same locality (ex Rothschild Collection; 16478, 16483); USNM.

REMARKS.—The female specimen in the British Museum (Natural History), indicated as the type of *anemonantha* (Clarke, 1958, p. 200), is merely a pseudotype which was collected in 1934. The real holotype of *anemonantha* is deposited in the Deutsches Entomologisches Institut, Berlin; it was seen by the present author and compared with other examined specimens of this species.

The species varies in the size and shape of the marginal spots of the forewing and in the mode of their confluence among themselves and the smaller, contiguous spots. The number and size of the discoidal spots are inconstant. On the hindwings of the females only the terminal and subterminal spots are present; the males have some additional spots and oblique streaks also in the discoidal area.

Appendix

The three species below were described as members of the genus *Pseudatteria* or were transferred additionally to it.

Idolatteria orgias (Meyrick), new combination

Pseudatteria orgias Meyrick, 1930, Exotic Microlepidoptera, vol. 3, p. 607.—Clarke, 1955, Catalogue of the type specimens of Microlepidoptera in the British Museum described by Edward Meyrick, vol. 1, p. 227; 1958, op. cit., vol. 3, p. 199, pl. 99, figs. 3–3c.

Family Tortricidae, subfamily Tortricinae, tribe Archipini.

Idolatteria xanthocapna (Meyrick), new combination

Pseudatteria xanthocapna Meyrick, 1930, Exotic Microlepidoptera, vol. 3, p. 607.—Clarke, 1955, Catalogue of the type specimens of Microlepidoptera in the British Museum described by Edward Meyrick, vol. 1, p. 326; 1958, op. cit., vol. 3, p. 200, pl. 100, figs. 4–4b.

Family Tortricidae, subfamily Tortricinae, tribe Archipini.

***Eumimographe lydia* (Druce), new combination**

Atteria lydia Druce, 1901, Ann. Mag. Nat. Hist., ser. 7, vol. 7, p. 440.
Pseudatteria lydia.—Meyrick, 1912, *in* Wagner, Lepidopterorum catalogus, pt. 10, p. 16; 1913, *in* Wytsman, Genera insectorum, fasc. 149, p. 22.

Family Oecophoridae.

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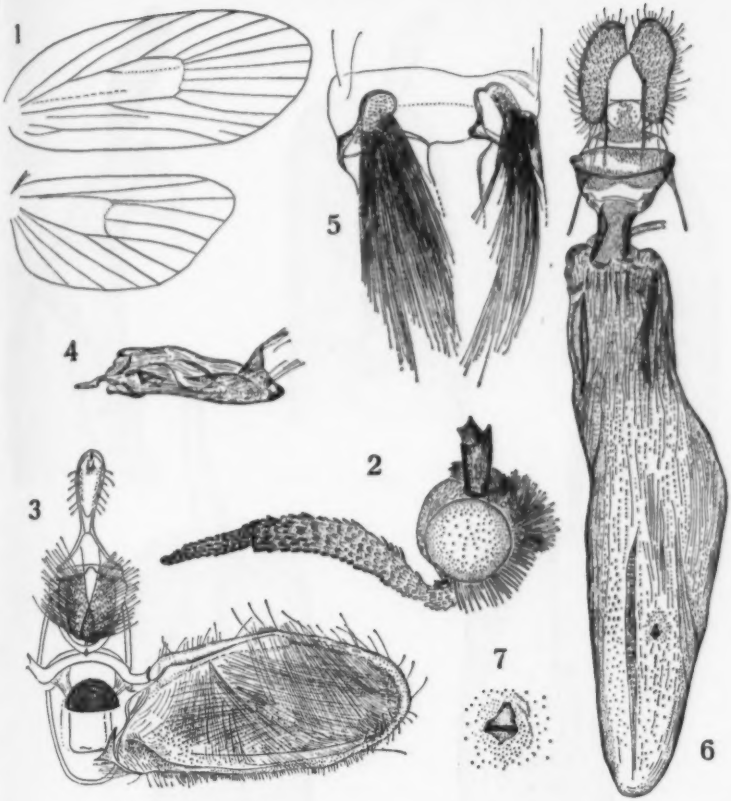
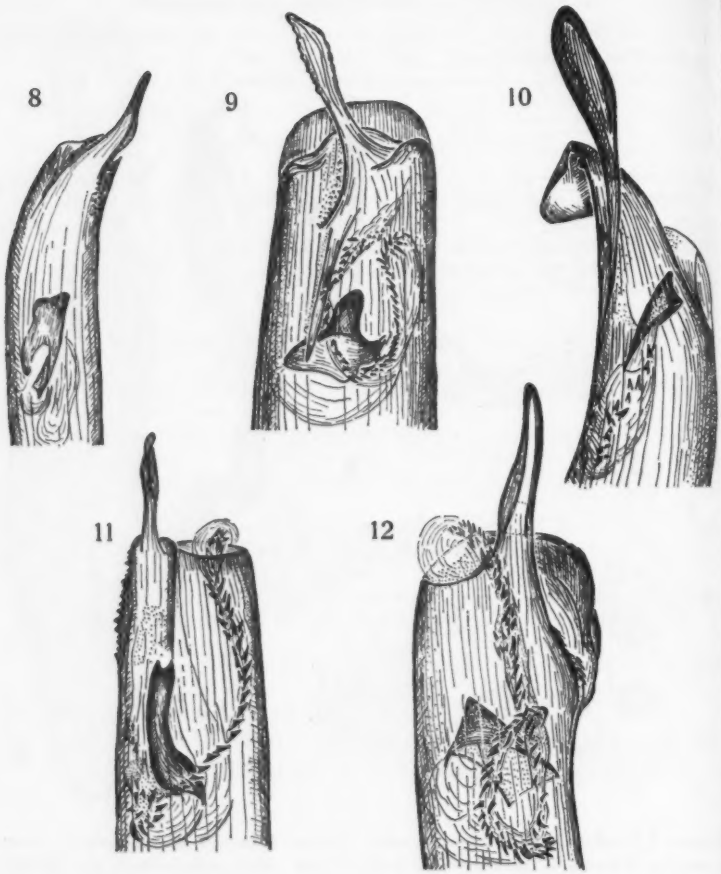
1913, 1914. [*Pseudatteria*]. *In* Biologia Centrali-Americana, vol. 42, Lepidoptera Heterocera, vol. 4, p. 214 (1913); pp. 267–271 (1914).

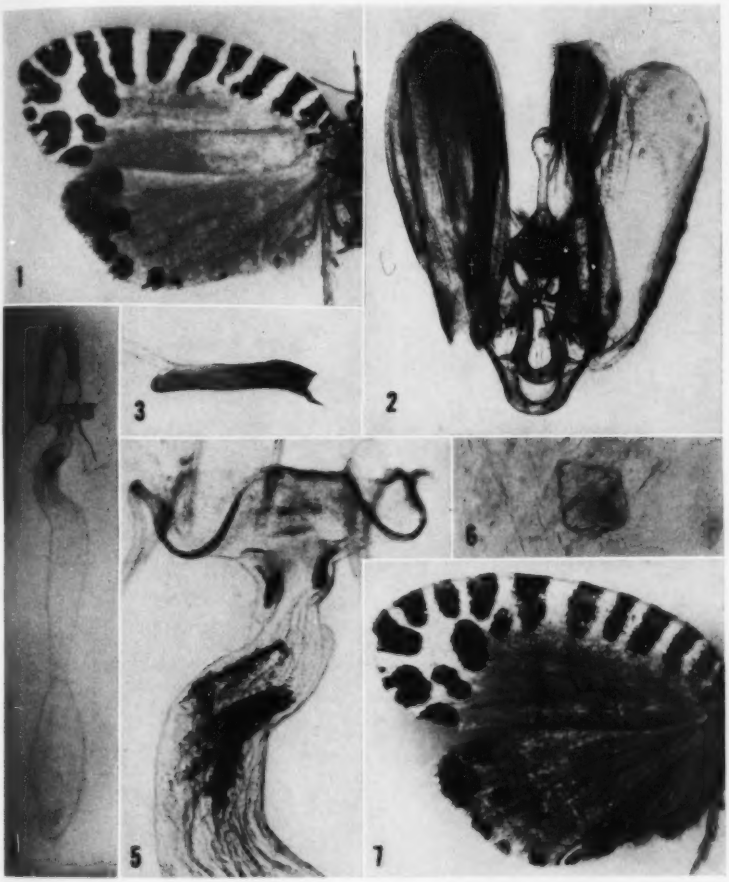


FIGURES 1–7.—*Pseudatteria volcanica rivularis* (Butler) (*potamites* Walsingham): 1, wing venation of female; 2, lateral aspect of head of male. Male genitalia (slide 4412, JFGC; Jalapa, Mexico, 4500 ft., 1887; USNM): 3, caudocephalic aspect (left valvae and aedeagus removed); 4, aedeagus; 5, ventral aspect of eighth-ninth intersegmental membrane with coremata and bases of valvae. Female genitalia: 6, ventral aspect (slide 4408, JFGC; Vera Cruz, Mexico; USNM); 7, signum (slide 4413, JFGC; Jalapa, Mexico, 4500 ft., 1887; USNM).

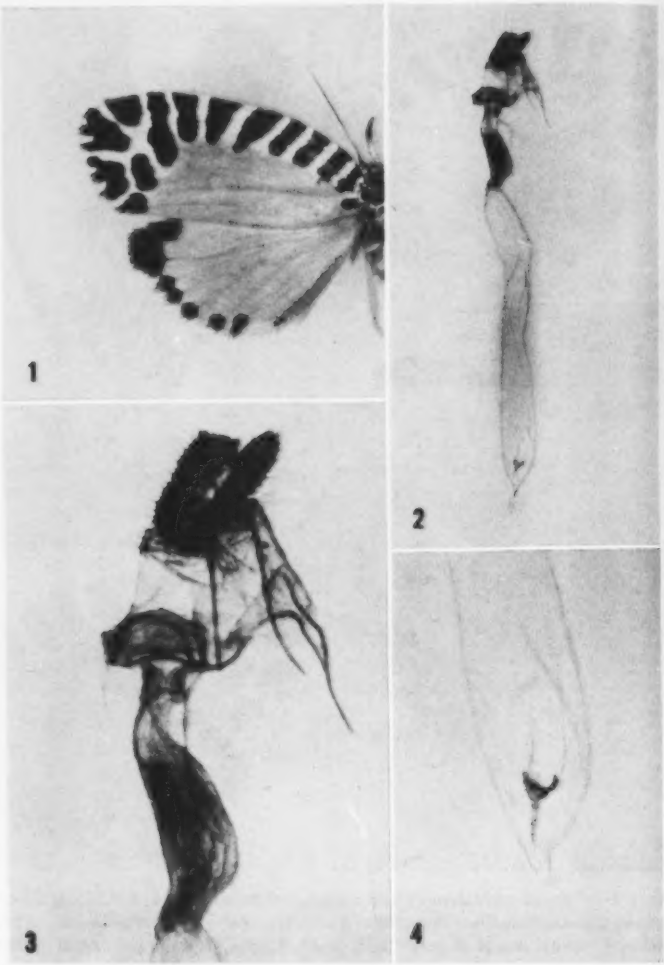


FIGURES 8–12.—Armatures of aedeagi of *Pseudatteria* species: 8, *P. dognini*, new species (holotype); 9, *P. cladodes* Walsingham (slide 6615; Peru; BM); 10, *P. marmarantha* Meyrick (slide 6611; Cañon del Monte Tolima, Colombia; BM); 11, *P. splendens* (Druce) (slide 6612; Sarayacu, Ecuador; BM); 12, *P. volcanica rivularis* (Butler) (slide 6616; Senahú, Guatemala, 2800 ft., November 1879; BM).

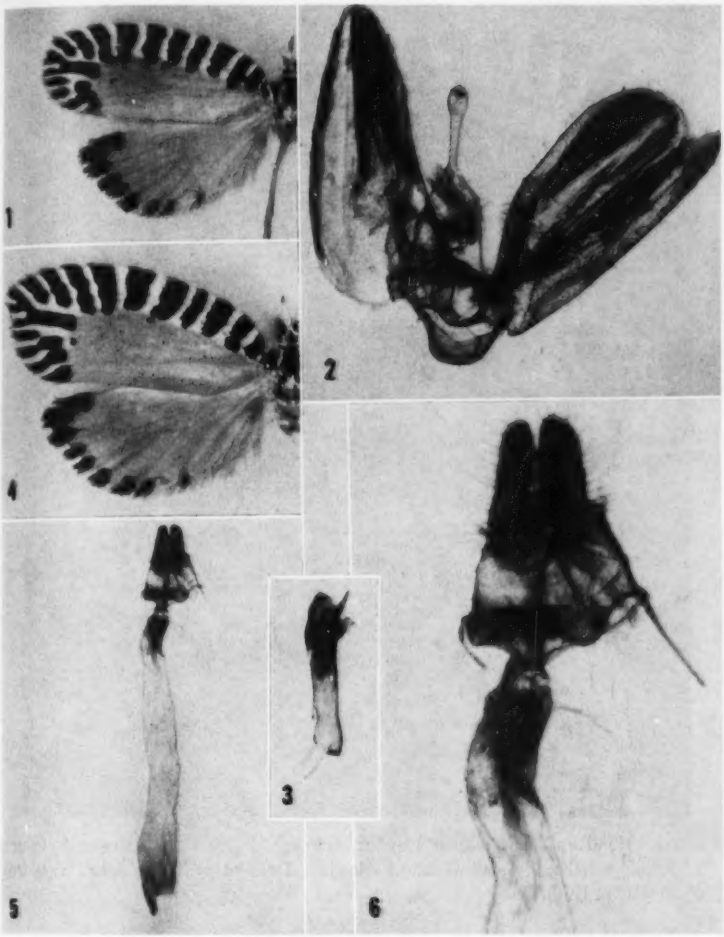
Plates



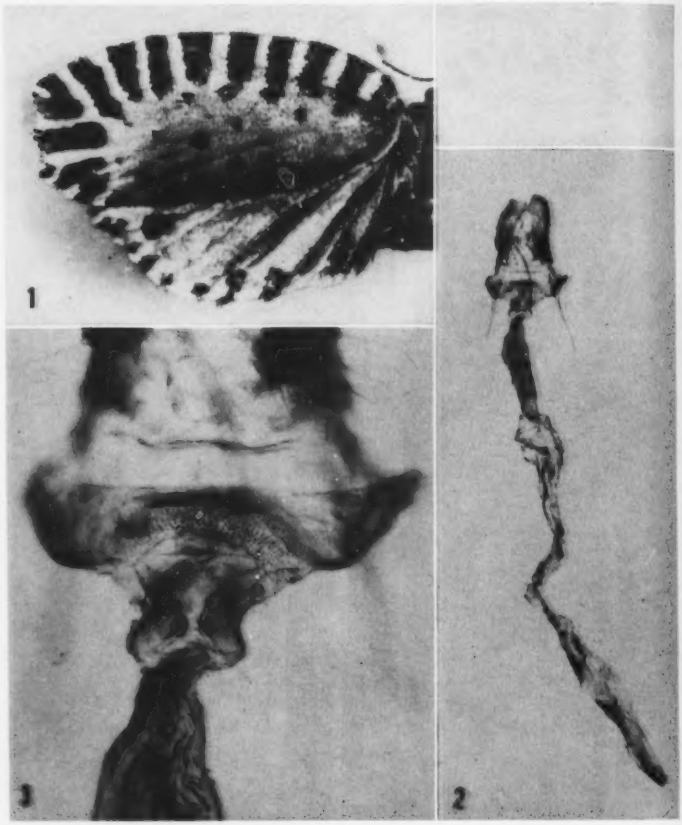
FIGURES 1–7.—*Pseudatteria dognini*, new species, holotype, male: 1, left wings; 2, caudocephalic aspect of genitalia with aedeagus removed; 3, lateral aspect of aedeagus. Allotype, female: 4, ventral aspect of genitalia; 5, detail of sinus vaginalis and caudal portion of bursa copulatrix; 6, signum. Species near *P. dognini*, female, Loja vicinity, Loja, Ecuador, 1887 (Dognin Collection, USNM): 7, right wings (image reversed).



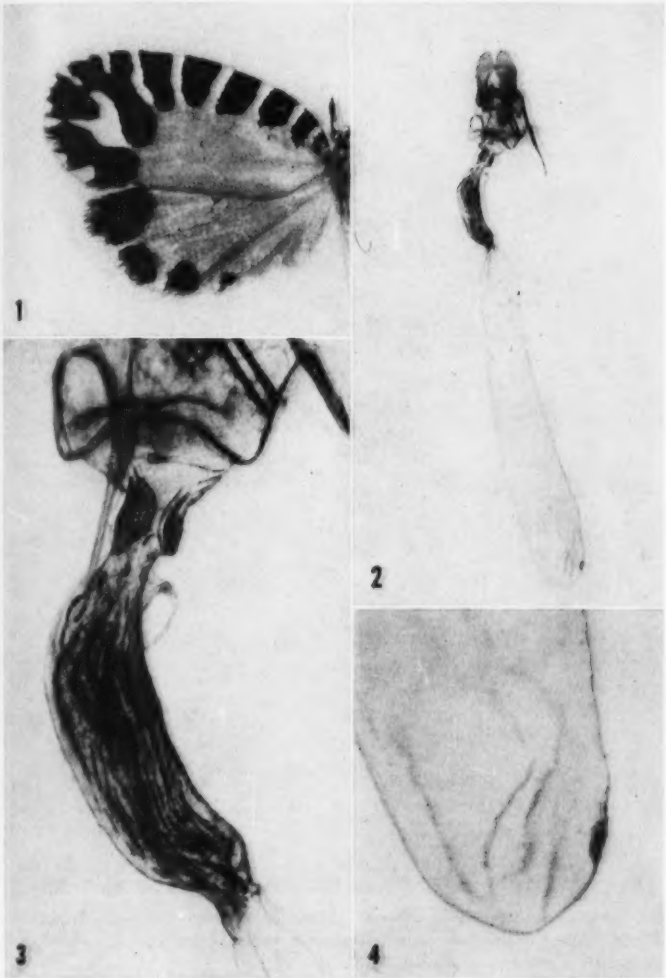
FIGURES 1–4.—*Pseudatteria shafferi*, new species, holotype, female: 1, left wings; 2, ventral aspect of genitalia; 3, detail of sinus vaginalis and caudal portion of bursa copulatrix; 4, signum.



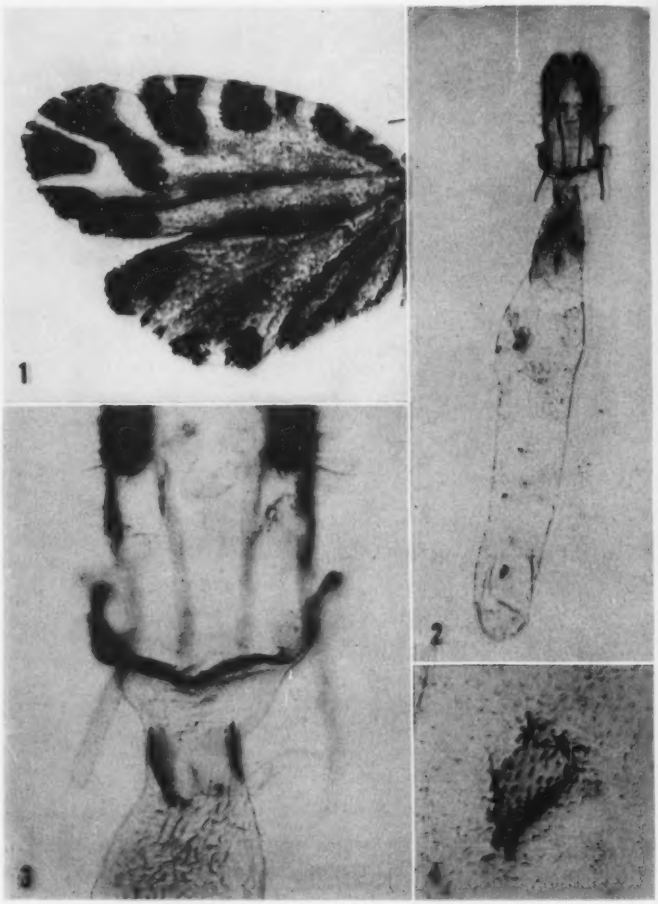
FIGURES 1–6.—*Pseudatteria pseudomaenas*, new species, holotype, male: 1, left wings; 2, caudocephalic aspect of genitalia with aedeagus removed; 3, lateral aspect of aedeagus. Allotype, female: 4, left wings; 5, ventral aspect of genitalia; 6, detail of sinus vaginalis and caudal portion of bursa copulatrix.



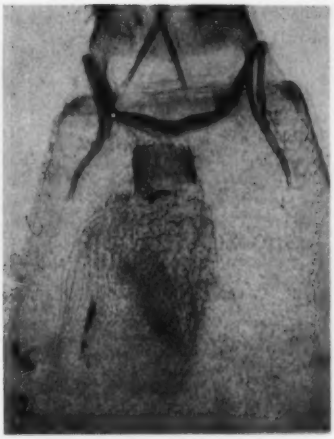
FIGURES 1–3.—*Pseudatteria maenas* Meyrick, holotype, female: 1, left wings; 2, ventral aspect of genitalia; 3, detail of sinus vaginalis and caudal portion of bursa copulatrix (from Clarke, 1958).

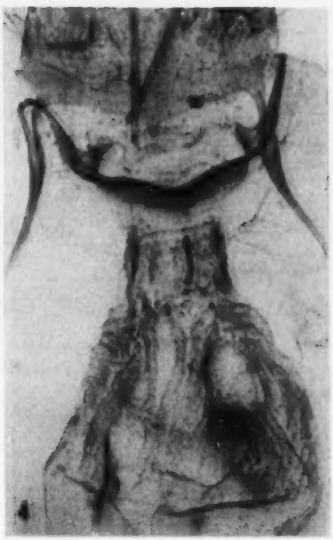


FIGURES 1–4.—*Pseudatteria tremewani*, new species, holotype, female: 1, left wings; 2, ventral aspect of genitalia; 3, detail of sinus vaginalis and caudal portion of bursa copulatrix; 4, detail of fundus bursae with signum.

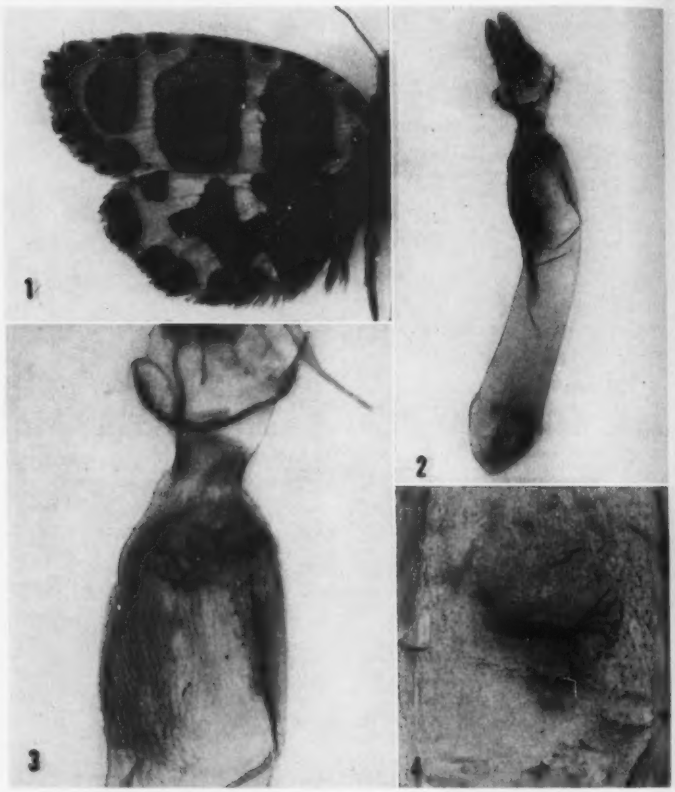


FIGURES 1–4.—*Pseudatteria chrysanthema* (Meyrick), lectotype, female: 1, left wings; 2, ventral aspect of genitalia; 3, detail of sinus vaginalis and caudal portion of bursa copulatrix; 4, signum (from Clarke, 1958).

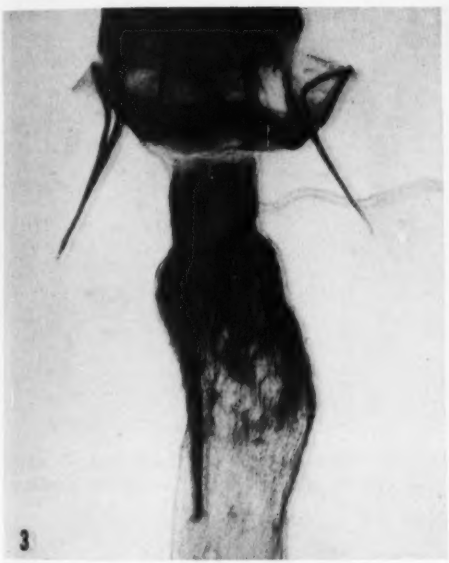




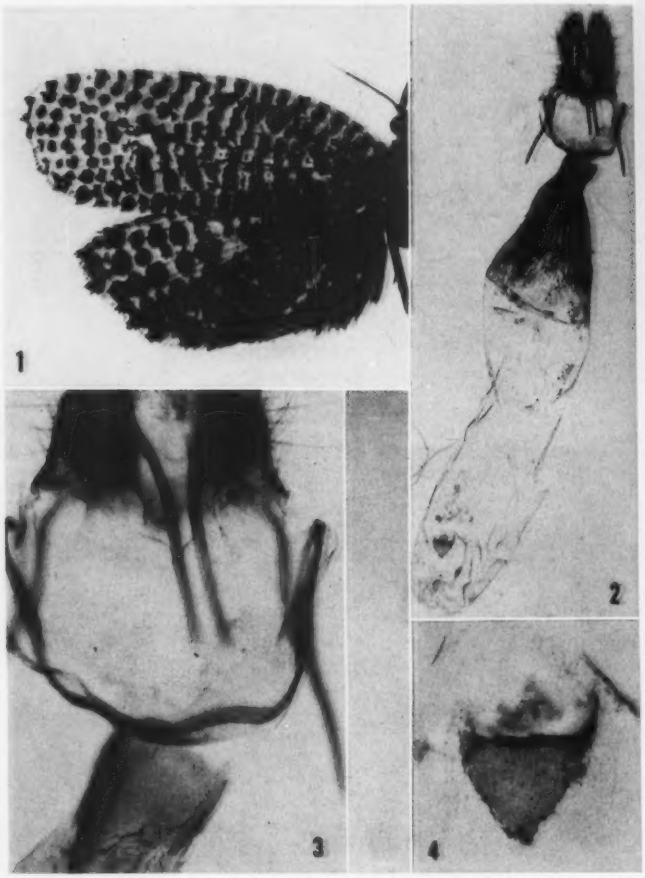
FIGURES 1–4.—*Pseudatteria chrysanthema* (Meyrick), details of sinus vaginalis and caudal portion of bursa copulatrix: 1, slide 4436, JFGC (Moyobamba, San Martín, Peru, "1er Sem." 1887; M. de Mathan), USNM; 2, slide, prepared by A. Busck on Mar. 30, 1926 (El Monje near Loja, Loja, Ecuador, 1893; Dognin), USNM; 3, slide 8655 (Rio Chanchosmayo, Cuzco, Peru, 1901; Hofmann), BM; 4, slide 636-Obr. (Venezuela), AMNH.



FIGURES 1–4.—*Pseudatteria analoga*, new species, holotype, female: 1, left wings; 2, ventral aspect of genitalia; 3, detail of sinus vaginalis and caudal portion of bursa copulatrix; 4, signum.

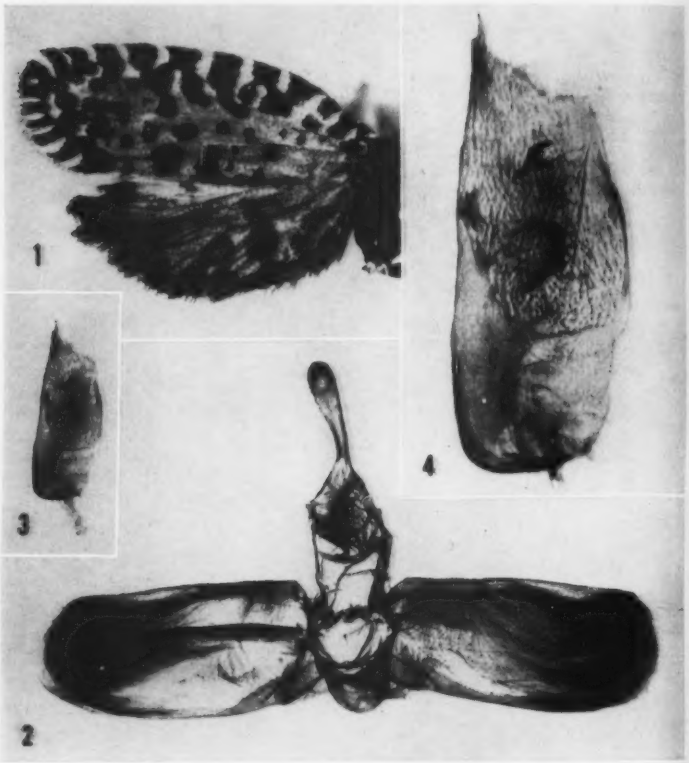


FIGURES 1–4.—*Pseudatteria unciana* (Dognin), holotype, female: 1, left wings; 2, ventral aspect of genitalia; 3, detail of sinus vaginalis and caudal portion of bursa copulatrix; 4, signum.

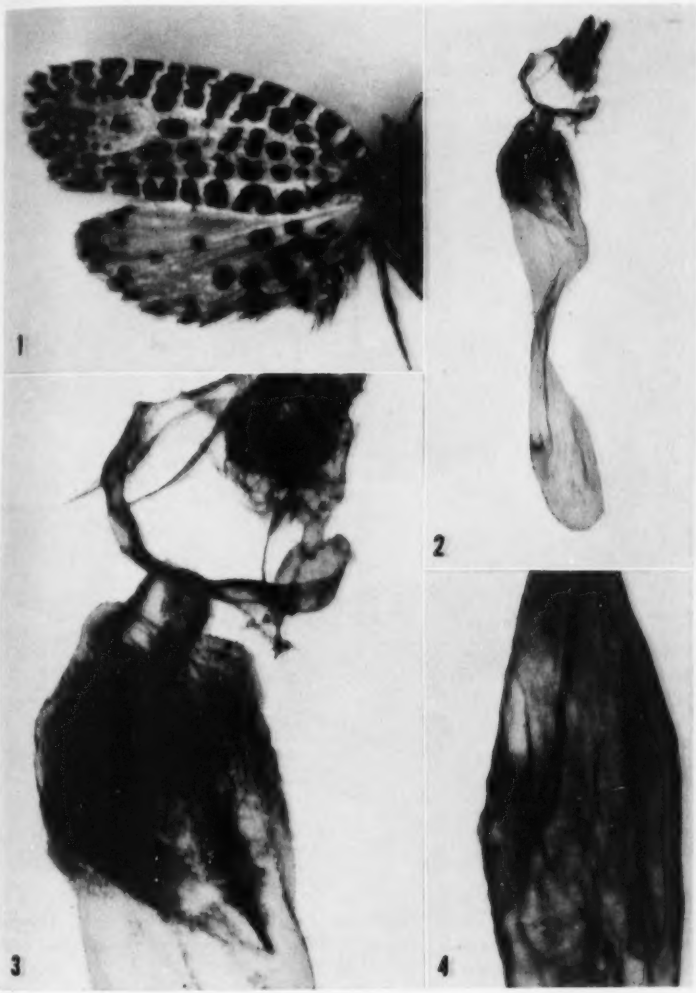


FIGURES 1–4.—*Pseudatteria myriocosma* Meyrick, holotype, female: 1, left wings; 2, ventral aspect of genitalia; 3, detail of sinus vaginalis and caudal portion of bursa copulatrix; 4, signum (from Clarke, 1958).

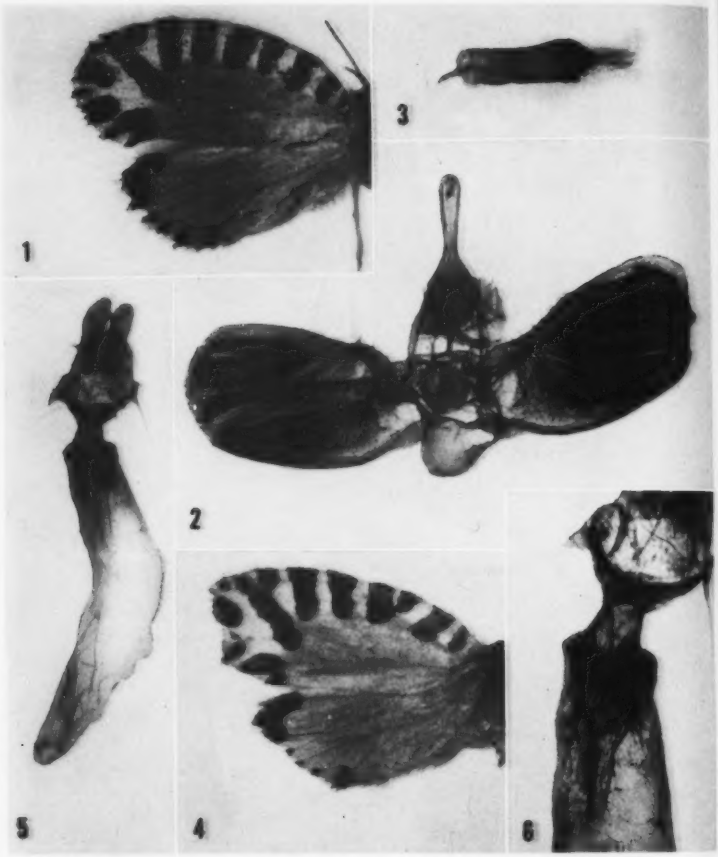
FIGURES 1–4.—*Pseudatteria pantherina* (Felder), holotype, female: 1, left wings; 2, ventral aspect of genitalia; 3, detail of sinus vaginalis and caudal portion of bursa copulatrix; 4, signum.



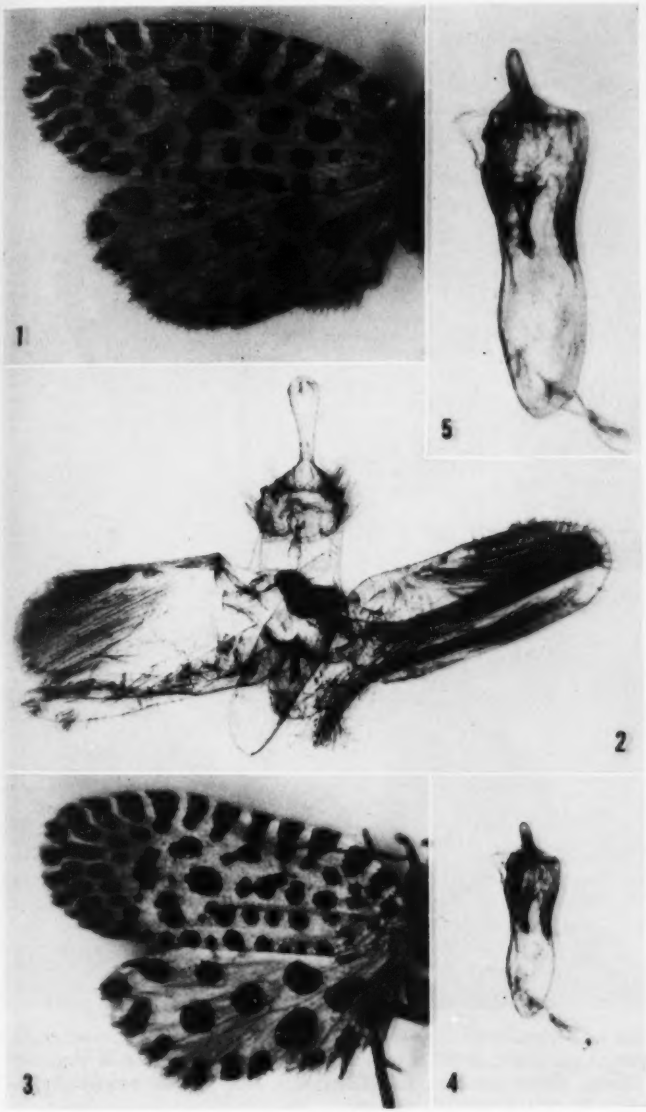
FIGURES 1–4.—*Pseudatteria fumipennis* (Dognin), holotype, male: 1, left wings; 2, caudocephalic aspect of genitalia; 3, lateral aspect of aedeagus; 4, details of aedeagus.



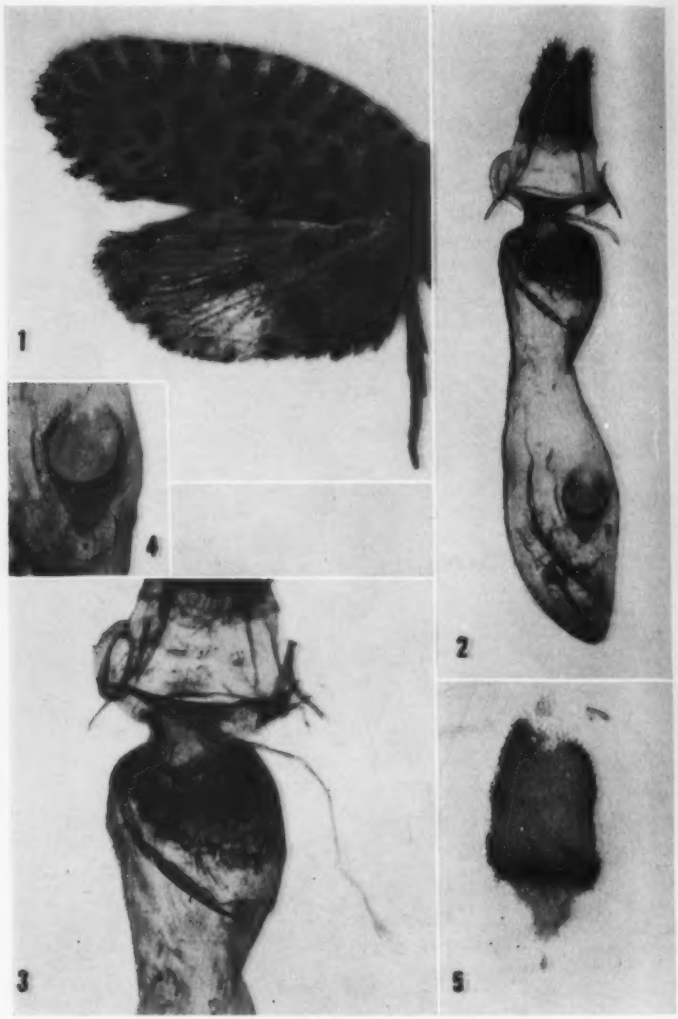
FIGURES 1–4.—*Pseudatteria ardoris*, new species, holotype, female: 1, left wings; 2, ventral aspect of genitalia; 3, detail of sinus vaginalis and caudal portion of bursa copulatrix; 4, signum.



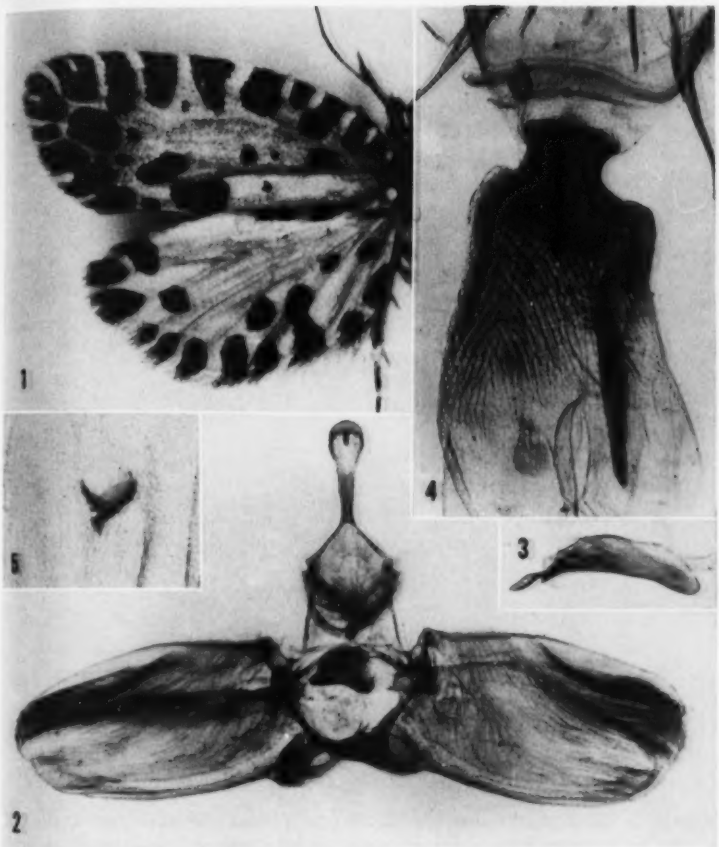
FIGURES 1–6.—*Pseudatteria cladodes* Walsingham, male, Peru (slide 6615), BM: 1, left wings; 2, caudocephalic aspect of genitalia; 3, ventral aspect of aedeagus. Holotype, female: 4, left wings; 5, ventral aspect of genitalia; 6, detail of sinus vaginalis and caudal portion of bursa copulatrix.



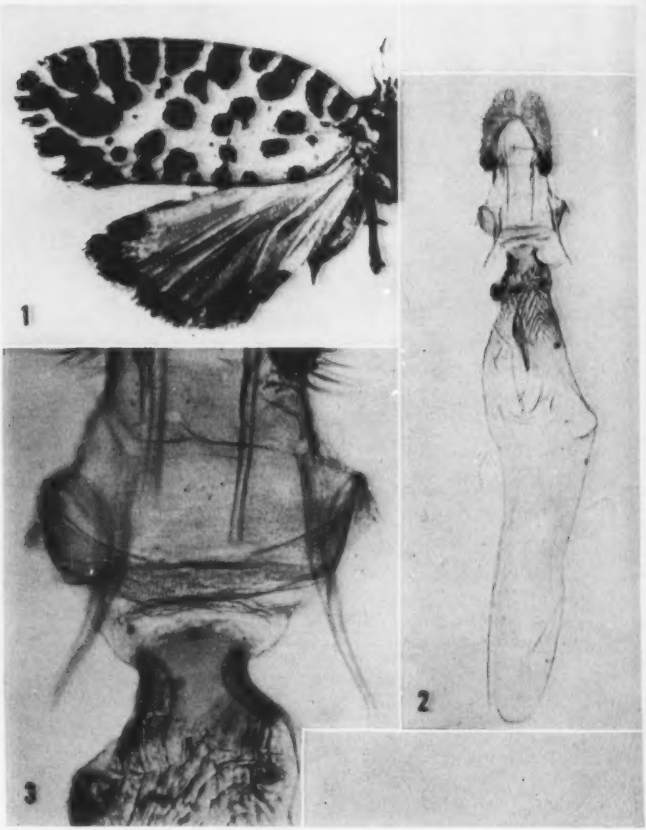
FIGURES 1–5.—*Pseudatteria leopardina* (Butler), males, Volcán de Poas, Costa Rica: 1, left wings; 2, caudocephalic aspect of genitalia (slide prepared by A. Busck on Sept. 28, 1920; USNM), Rio Cascajal, Costa Rica, May 1919 (slide 8654), BM; 3, left wings; 4. ventral aspect of aedeagus; 5, details of aedeagus.



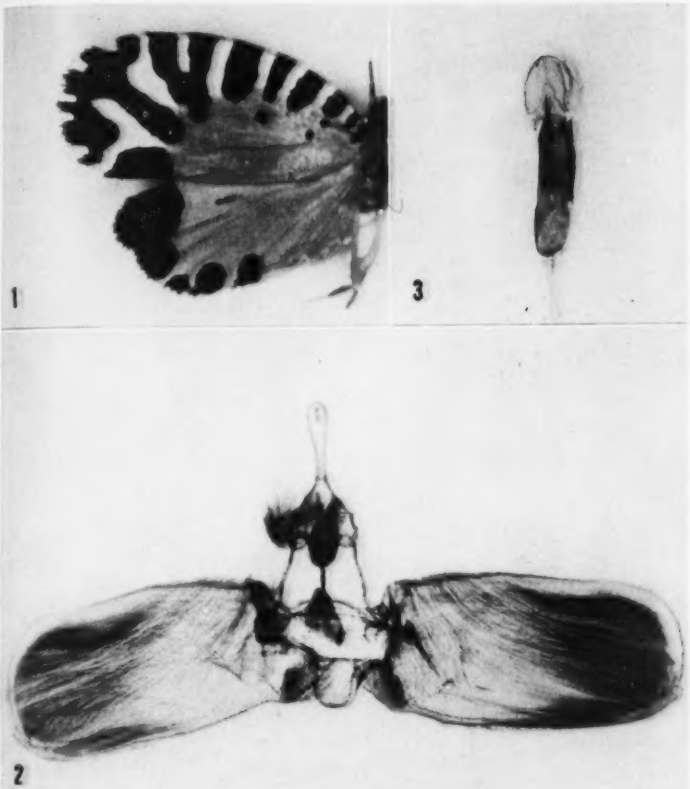
FIGURES 1–5.—*Pseudatteria leopardina* (Butler), holotype, female: 1, left wings; 2, ventral aspect of genitalia; 3, detail of sinus vaginalis and caudal portion of bursa copulatrix; 4, signum. Other specimen (Tuis, Costa Rica, 2400 ft.; slide prepared by A. Busck on Mar. 20, 1926; USNM): 5, signum.



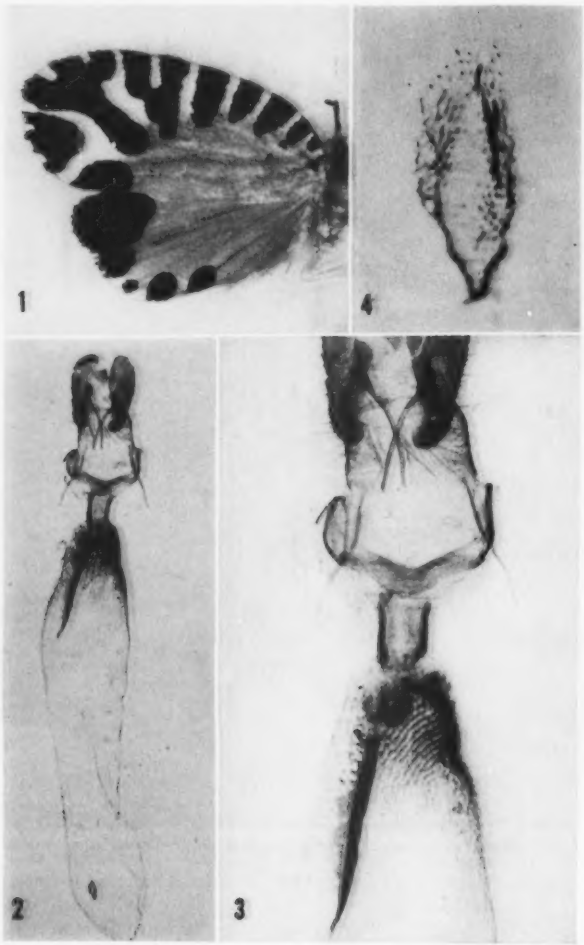
FIGURES 1–5.—*Pseudatteria marmarantha* Meyrick: male (slide 6611), Cañon del Monte Tolima, Colombia, 4700 m., BM: 1, left wings; 2, caudocephalic aspect of genitalia; 3, lateral aspect of aedeagus. Female (slide 4415, JFGC), Las Juntas, Colombia, USNM): 4, detail of sinus vaginalis and caudal portion of bursa copulatrix; 5, signum.



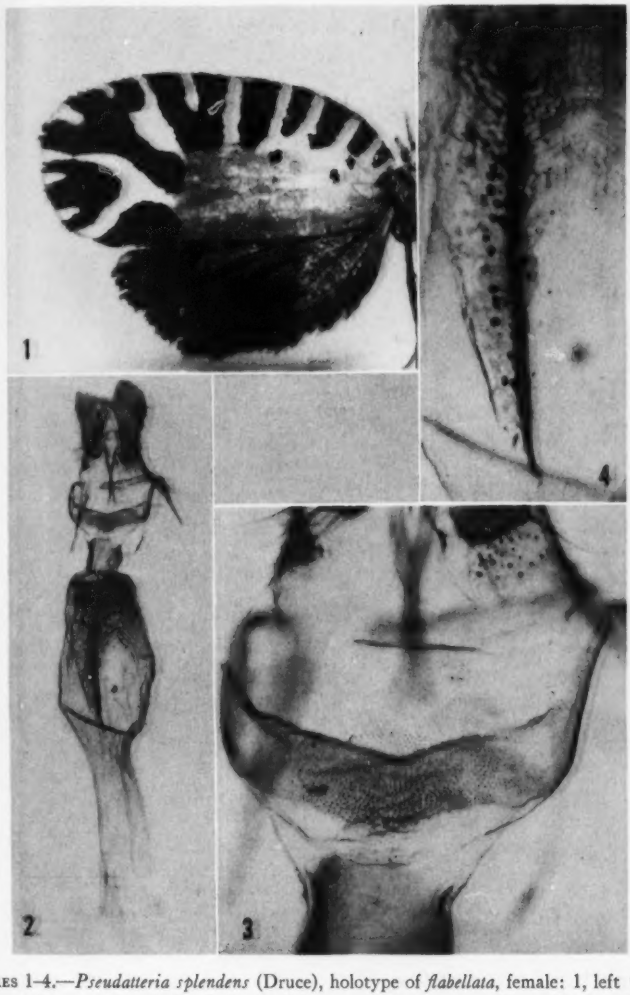
FIGURES 1–3.—*Pseudatteria marmarantha* Meyrick, lectotype, female: 1, left wings; 2 ventral aspect of genitalia; 3, detail of sinus vaginalis and caudal portion of bursa copulatrix (from Clarke, 1958).



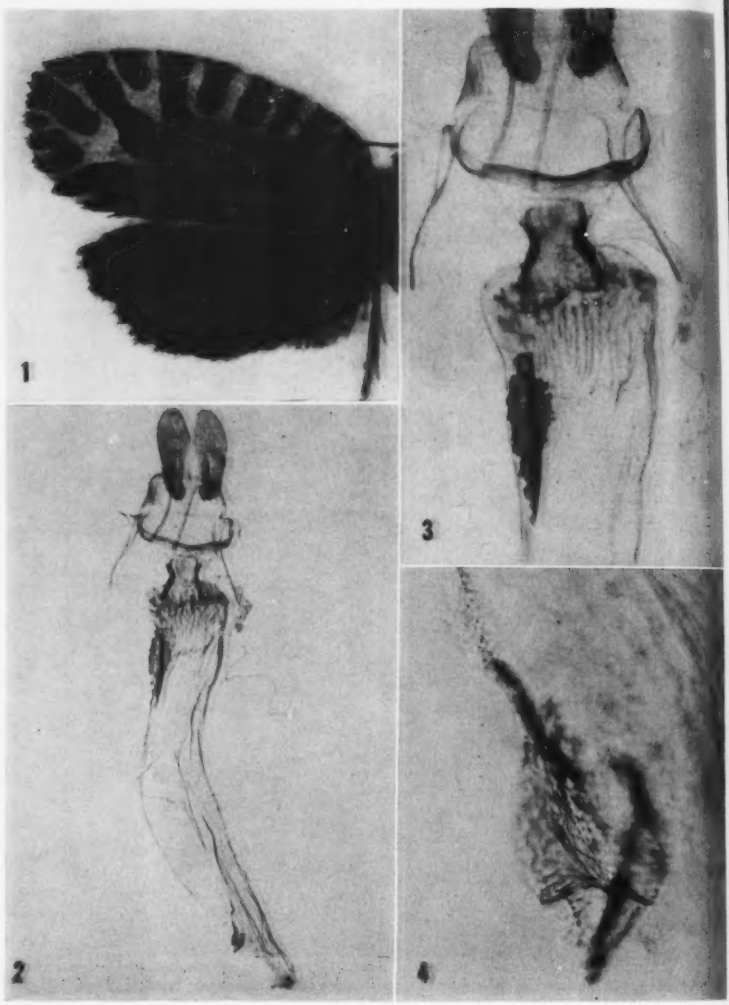
FIGURES 1–3.—*Pseudatteria splendens* (Druce), male (slide 6612), Sarayacu, Ecuador, BM: 1, left wings; 2, caudocephalic aspect of genitalia; 3, lateral aspect of aedeagus.



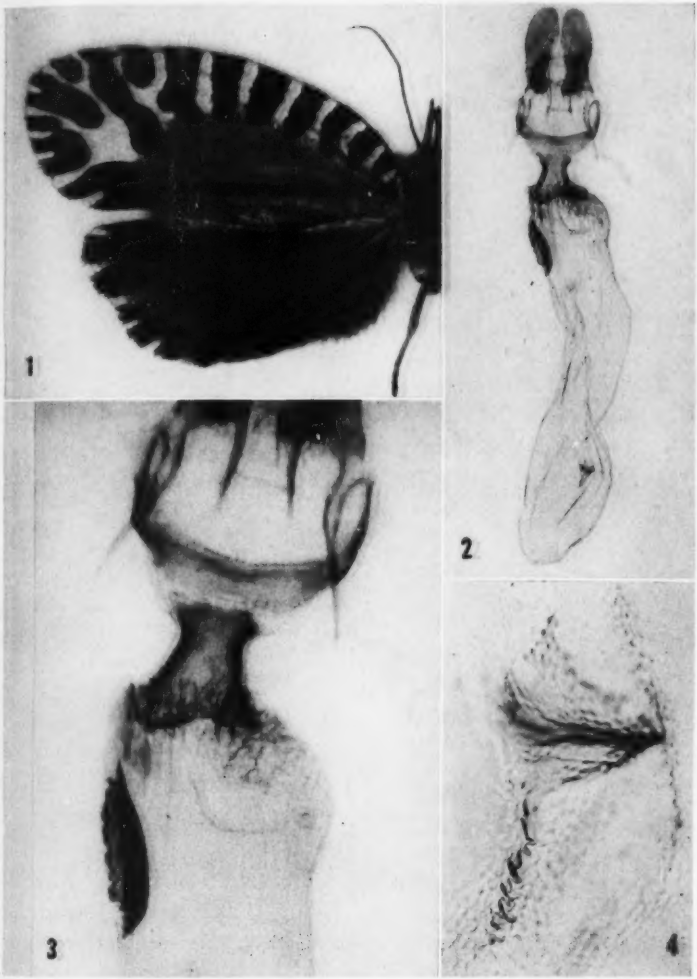
FIGURES 1–4.—*Pseudatteria splendens* (Druce), lectotype, female: 1, left wings; 2, ventral aspect of genitalia; 3, detail of sinus vaginalis and caudal portion of bursa copulatrix; 4, signum. (Figures 2 and 4 published with permission of the trustees of the British Museum, Natural History.)



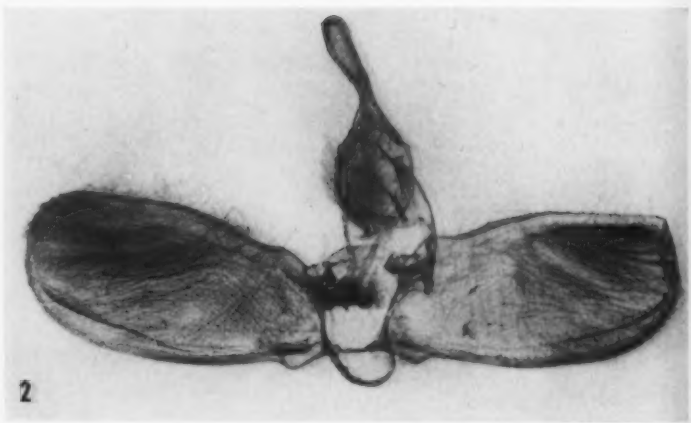
FIGURES 1–4.—*Pseudatteria splendens* (Druce), holotype of *flabellata*, female: 1, left wings; 2, ventral aspect of genitalia; 3, detail of sinus vaginalis; 4, cestum (from Clarke, 1958).



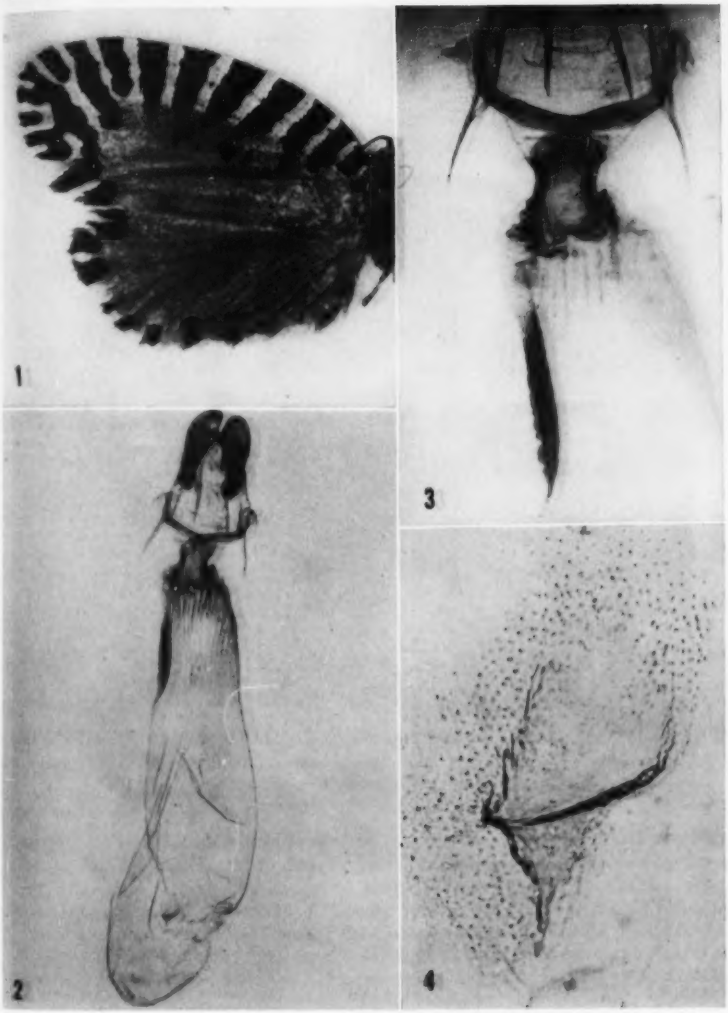
FIGURES 1–4.—*Pseudatteria volcanica volcanica* (Butler), holotype of *volcanica* Butler, female: 1, left wings; 2, ventral aspect of genitalia; 3, detail of sinus vaginalis and caudal portion of bursa copulatrix; 4, signum. (Figures 2 and 4 published with permission of the trustees of the British Museum, Natural History.)



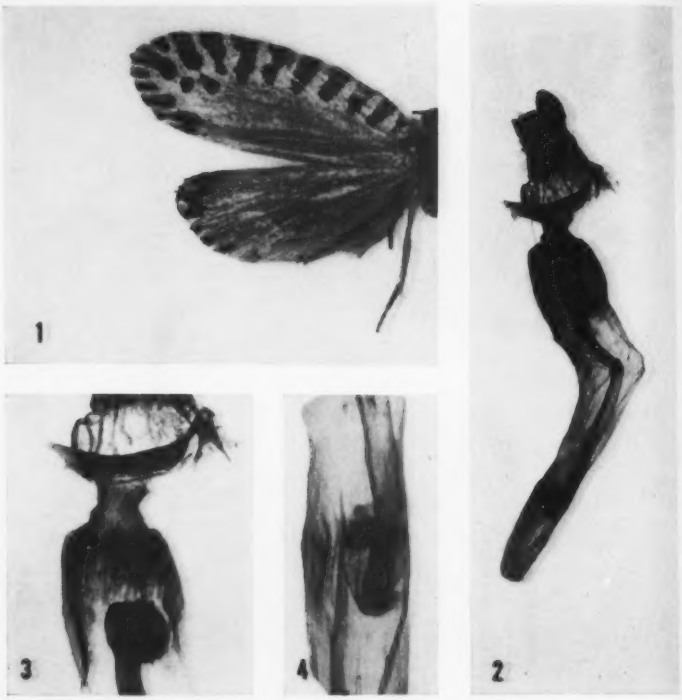
FIGURES 1–4.—*Pseudatteria volcanica volcanica* (Butler), holotype of *mimica* Felder, female: 1, left wings; 2, ventral aspect of genitalia; 3, detail of sinus vaginalis and caudal portion of bursa copulatrix; 4, signum. (Figures 2 and 4 published with permission of the trustees of the British Museum, Natural History.)



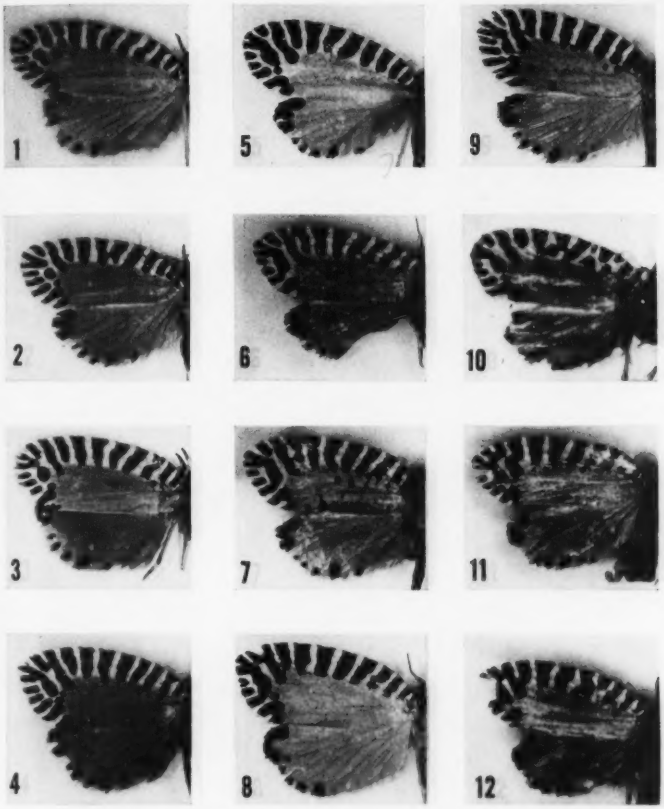
FIGURES 1–3.—*Pseudatteria volcanica rivularis* (Butler), lectotype of *potamites* Walsingham, male: 1, left wings; 2, caudocephalic aspect of genitalia; 3, lateral aspect of aedeagus.



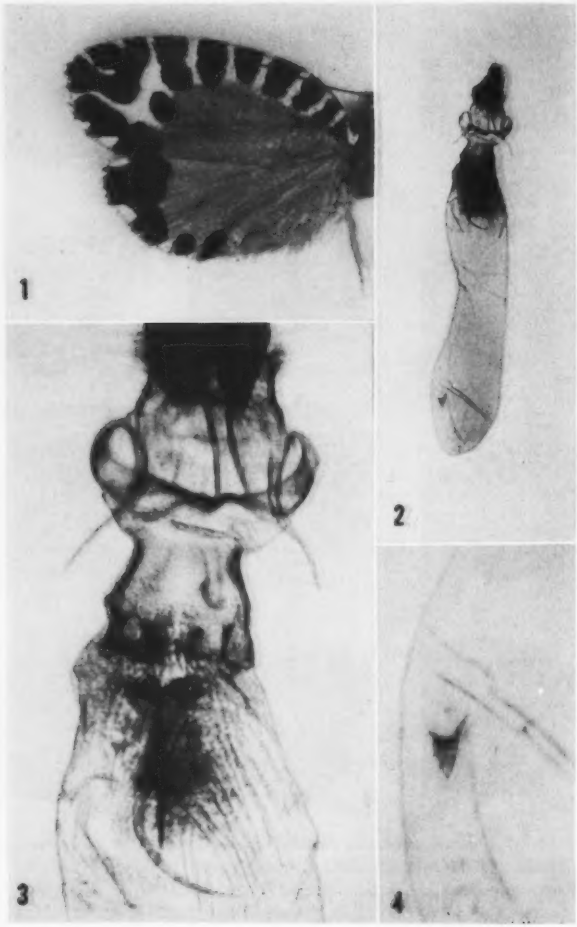
FIGURES 1–4.—*Pseudatteria volcanica rivularis* (Butler), lectotype of *rivularis* Butler, female: 1, left wings; 2, ventral aspect of genitalia; 3, detail of sinus vaginalis and caudal portion of bursa copulatrix; 4, signum. (Figures 2 and 4 published with permission of the trustees of the British Museum, Natural History.)



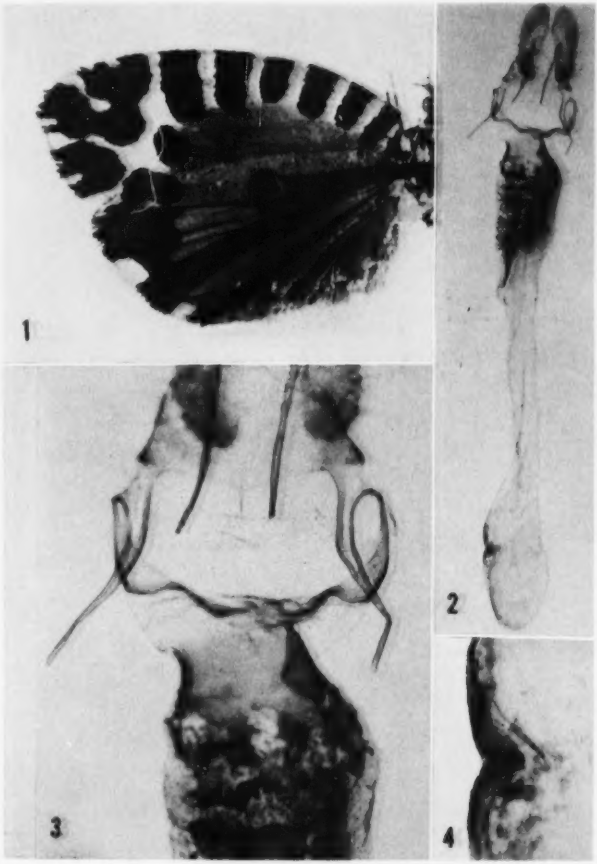
FIGURES 1–4.—*Pseudatteria volcanica rivularis* (Butler), holotype of *geminipuncta* Walsingham, female: 1, left wings; 2, ventral aspect of genitalia; 3, detail of sinus vaginalis and caudal portion of bursa copulatrix; 4, signum.



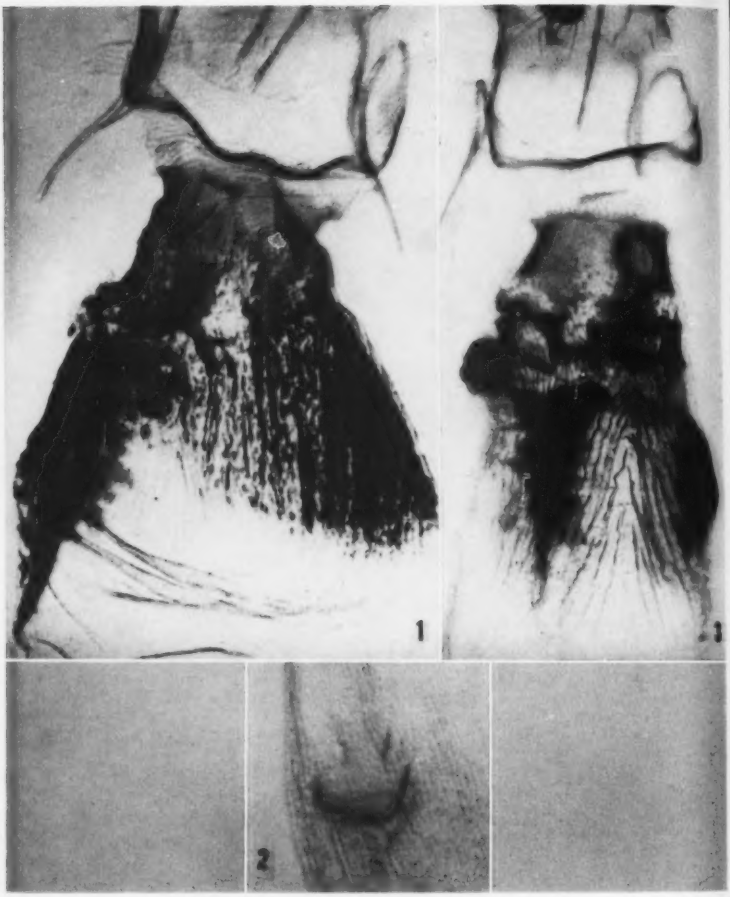
FIGURES 1–12.—*Pseudatteria volcanica rivularis* (Butler), variation: 1, female (slide 4603), Jalapa, Mexico, 4500 ft., 1887, BM; 2, female, same locality, USNM; 3, male (slide 6617), San Andrés Tuxtla, Mexico, April 1914; 4, female (slide A.B., Mar. 11, 1926), Tactic, Guatemala, July, USNM; 5, female, Tuis, Costa Rica, USNM; 6, 7, female, Purulá, Guatemala, USNM; 8, female, Volcán de Santa Maria, Guatemala, June, USNM; 9, female, Guatemala, USNM; 10, male, Senahú, Guatemala, 2800 ft., November 1879, BM; 11, 12, male (slide 635-Obr.), Matagulpa, Nicaragua, June 28, 1953, AMNH. (1–5, 7–11, left wings; 6, 12, right wings, reversed images.)



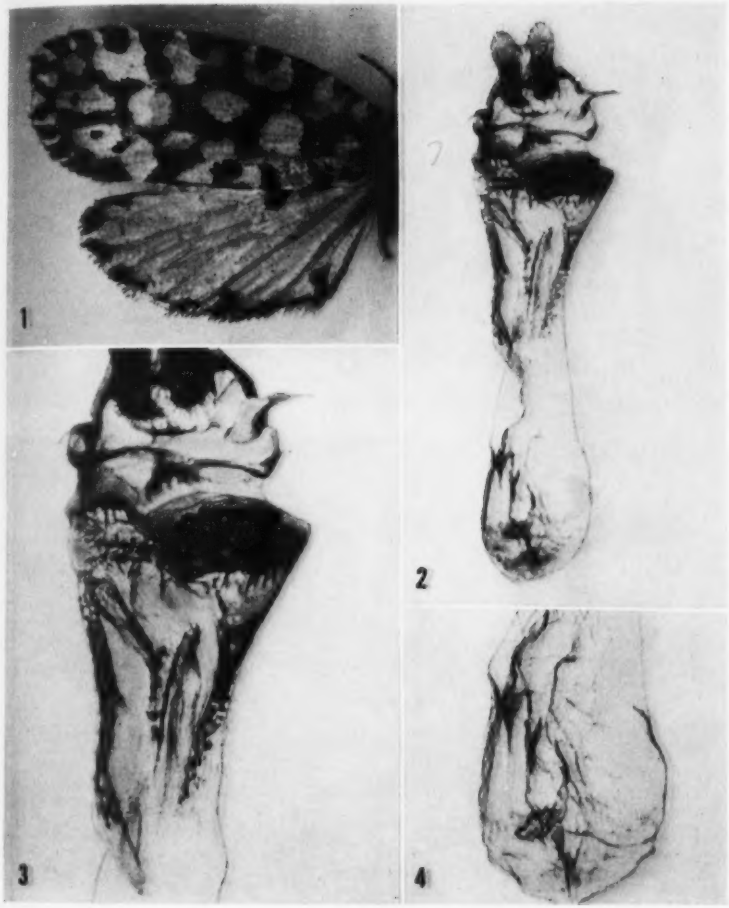
FIGURES 1–4.—*Pseudatteria bradleyi*, new species, holotype, female: 1, right wings (image reversed); 2, ventral aspect of genitalia; 3, detail of sinus vaginalis and caudal portion of bursa copulatrix; 4, signum.



FIGURES 1–4.—*Pseudatteria igniflora* Meyrick, holotype, female: 1, left wings; 2, ventral aspect of genitalia; 3, detail of sinus vaginalis and caudal portion of bursa copulatrix; 4, signum (from Clarke, 1958).

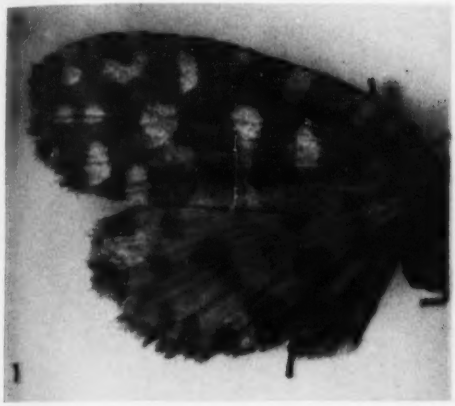


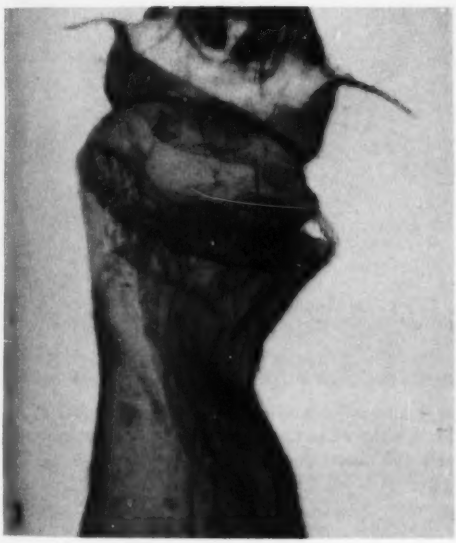
FIGURES 1–3.—*Pseudatteria igniflora* Meyrick, details of female genitalia, slide M.1030 (Chapare, Bolivia, 400 m., June 1951), ZSM: 1, sinus vaginalis and caudal portion of bursa copulatrix; 2, signum; slide 4532 JFGC (Bolivia), USNM: 3, sinus vaginalis and caudal portion of bursa copulatrix.

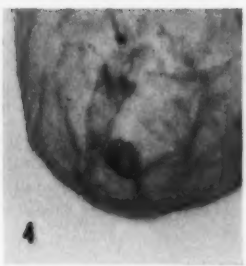


FIGURES 1–4.—*Pseudatteria dictyanthes* Meyrick, holotype, female: 1, left wings; 2, ventral aspect of genitalia; 3, detail of sinus vaginalis and caudal portion of bursa copulatrix; 4, signum.

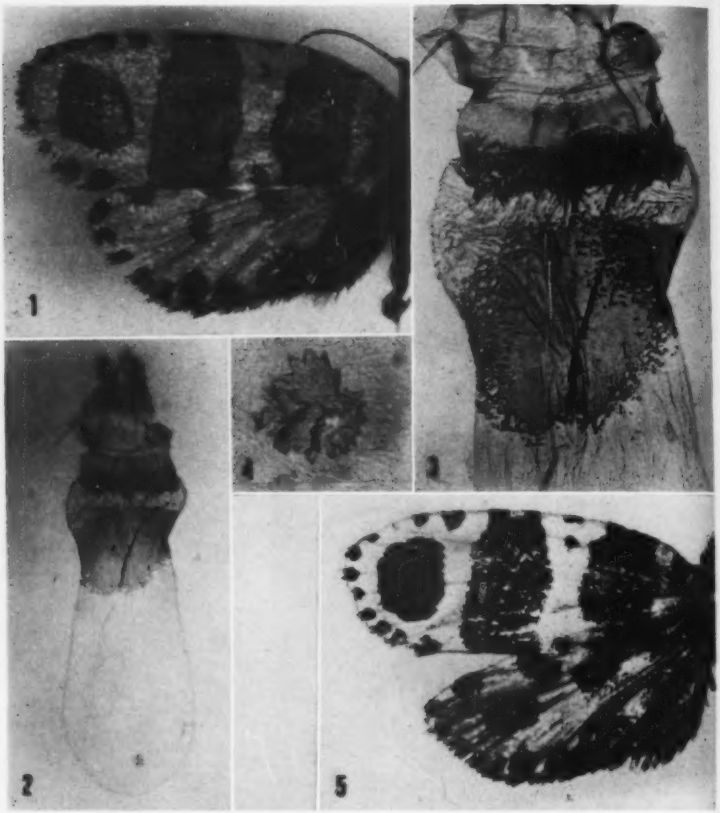
FIGURES 1–3.—*Pseudatteria buckleyi* (Druce), holotype, male: 1, left wings; 2, caudocephalic aspect of genitalia; 3, aedeagus.



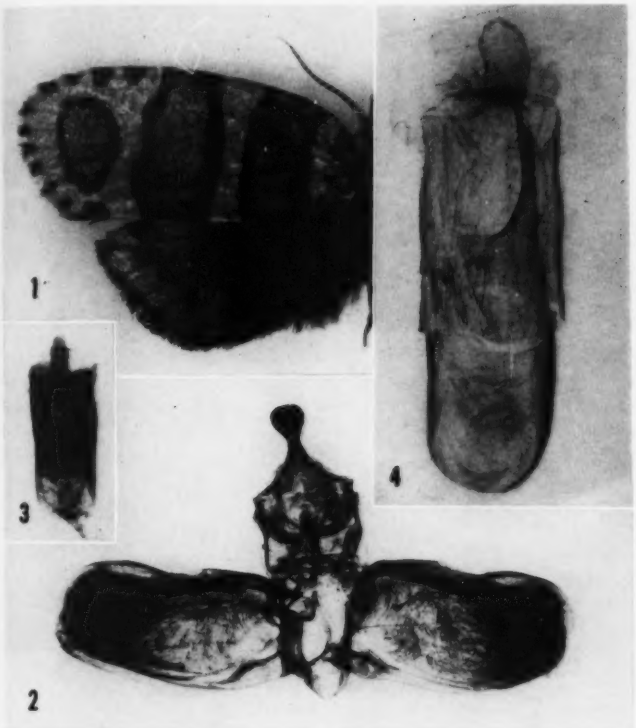




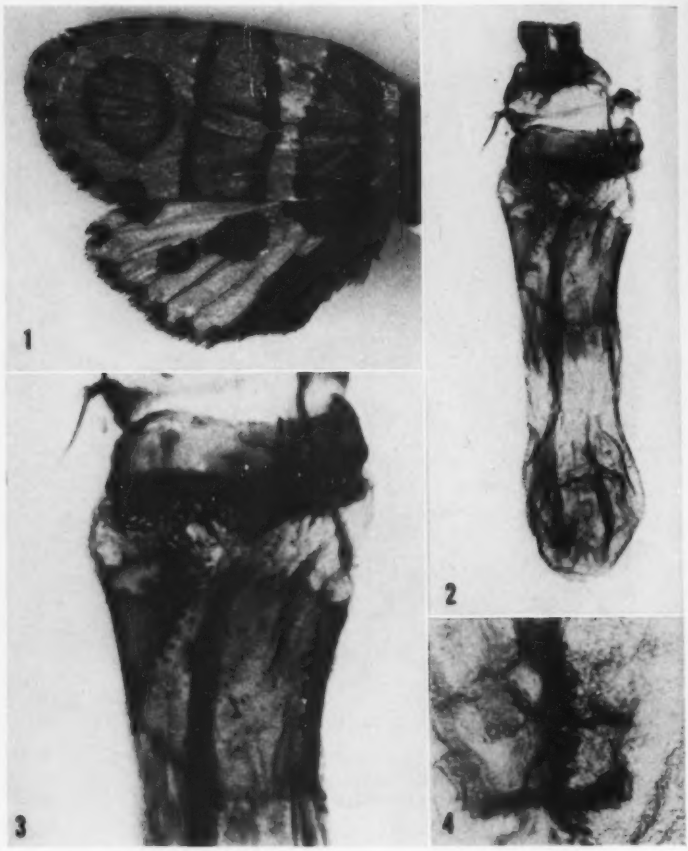
FIGURES 1–4.—*Pseudatteria buckleyi* (Druce), females: 1, holotype of *purpurea* Dognin, right wings (image reversed), slide 6625 (Chiguinda, Ecuador), BM; 2, ventral aspect of genitalia; 3, detail of sinus vaginalis and caudal portion of bursa copulatrix; 4, signum.



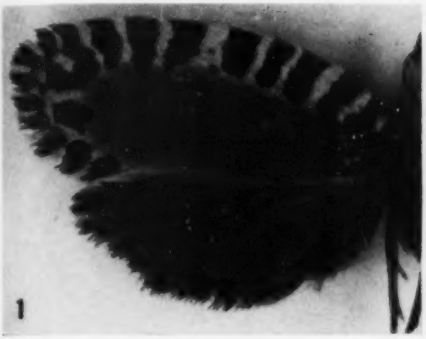
FIGURES 1–5.—*Pseudatteria cantharopa cantharopa* (Meyrick), females, slide M.1011 (Yungas, Bolivia, 1500–2000 m.), ZSM: 1, right wings (image reversed); 2, ventral aspect of genitalia; 3, detail of sinus vaginalis and caudal portion of bursa copulatrix; 4, signum. Holotype, female: 5, left wings (from Clarke, 1958).

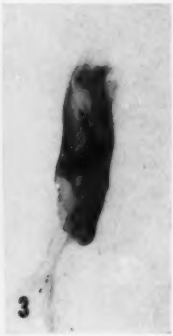


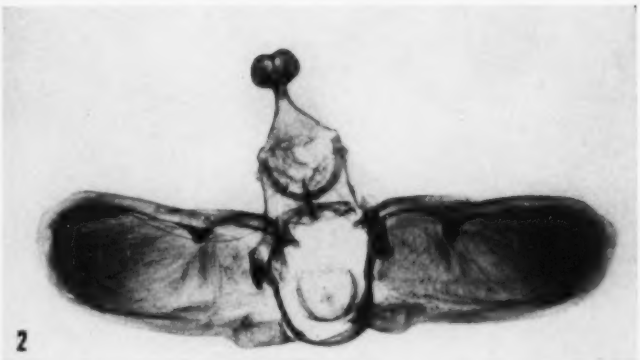
FIGURES 1–4.—*Pseudatteria cantharopa pulchra*, new subspecies, holotype, male: 1, right wings (image reversed); 2, caudocephalic aspect of genitalia; 3, aedeagus, slide 6623 (Chachapoyas, Peru, 1889), BM; 4, aedeagus (strongly enlarged).



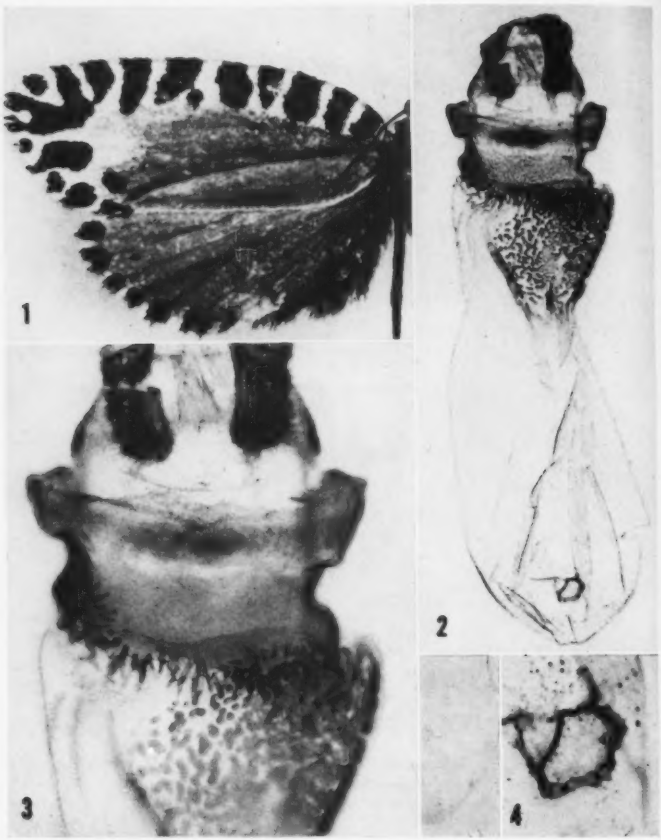
FIGURES 1–4.—*Pseudatteria cantharopa pulchra*, new subspecies, allotype, female: 1, left wings; 2, ventral aspect of genitalia; 3, detail of sinus vaginalis and caudal portion of bursa copulatrix; 4, signum.



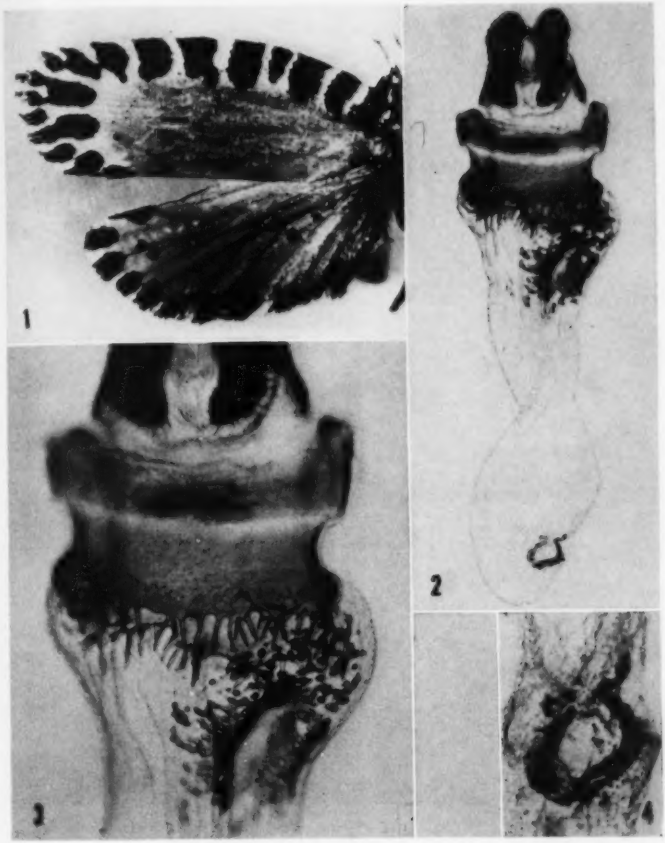




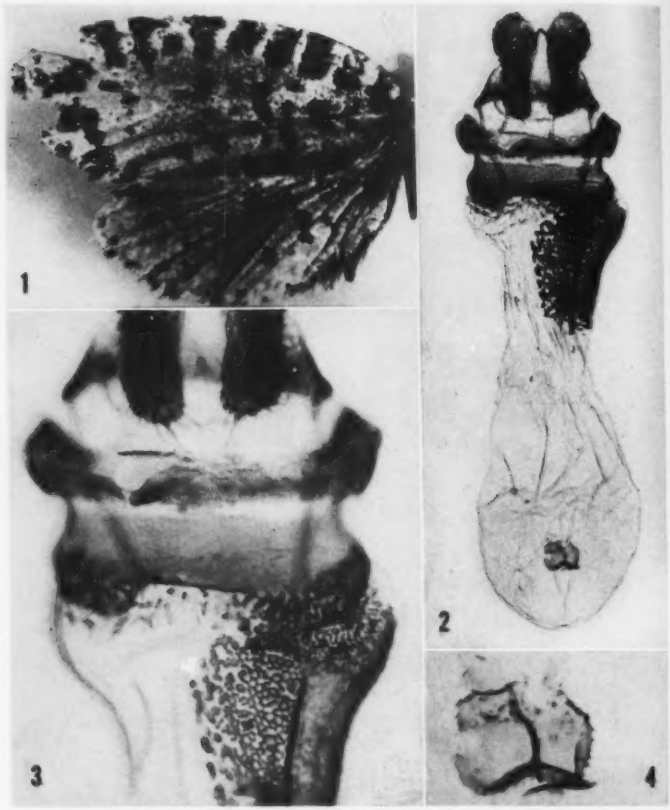
FIGURES 1–3.—*Pseudatteria heliocausta* (Dognin), lectotype, male: 1, left wings; 2, caudocephalic aspect of genitalia; 3, aedeagus.



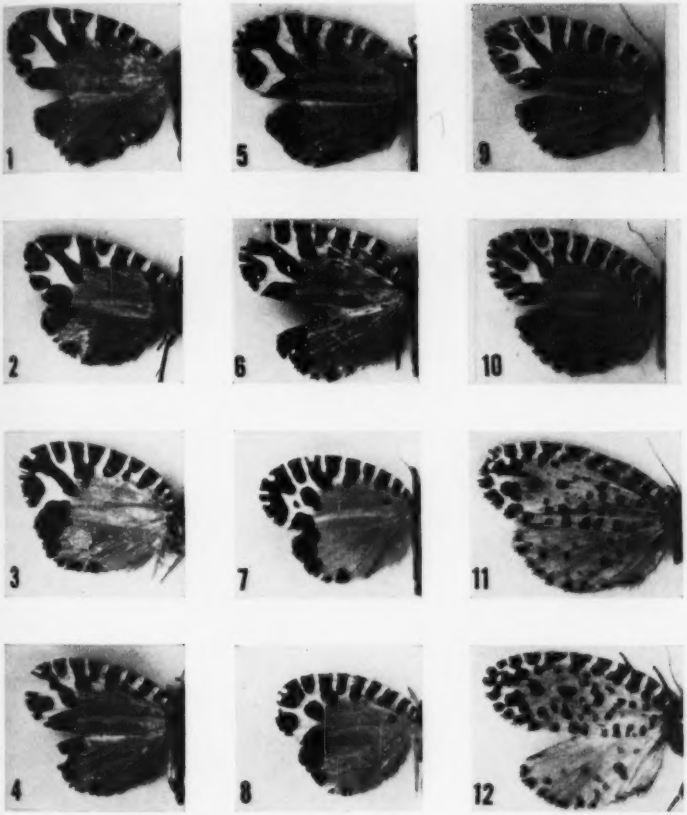
FIGURES 1–4.—*Pseudatteria heliocausta* (Dognin), lectotype of *fornicata*, female: 1, left wings; 2, ventral aspect of genitalia; 3, detail of sinus vaginalis and caudal portion of bursa copulatrix; 4, signum (from Clarke, 1958).



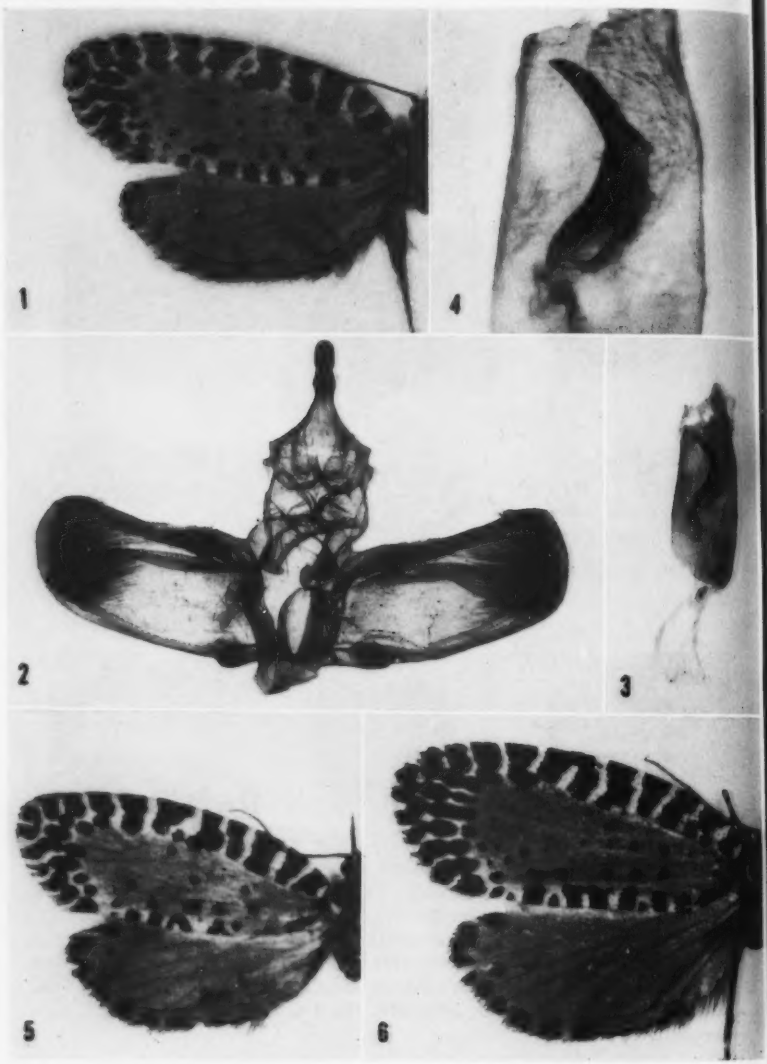
FIGURES 1–4.—*Pseudatteria heliocausta* (Dognin), lectotype of *metacapna*, female: 1, left wings; 2, ventral aspect of genitalia; 3, detail of sinus vaginalis and caudal portion of bursa copulatrix; 4, signum (from Clarke, 1958).



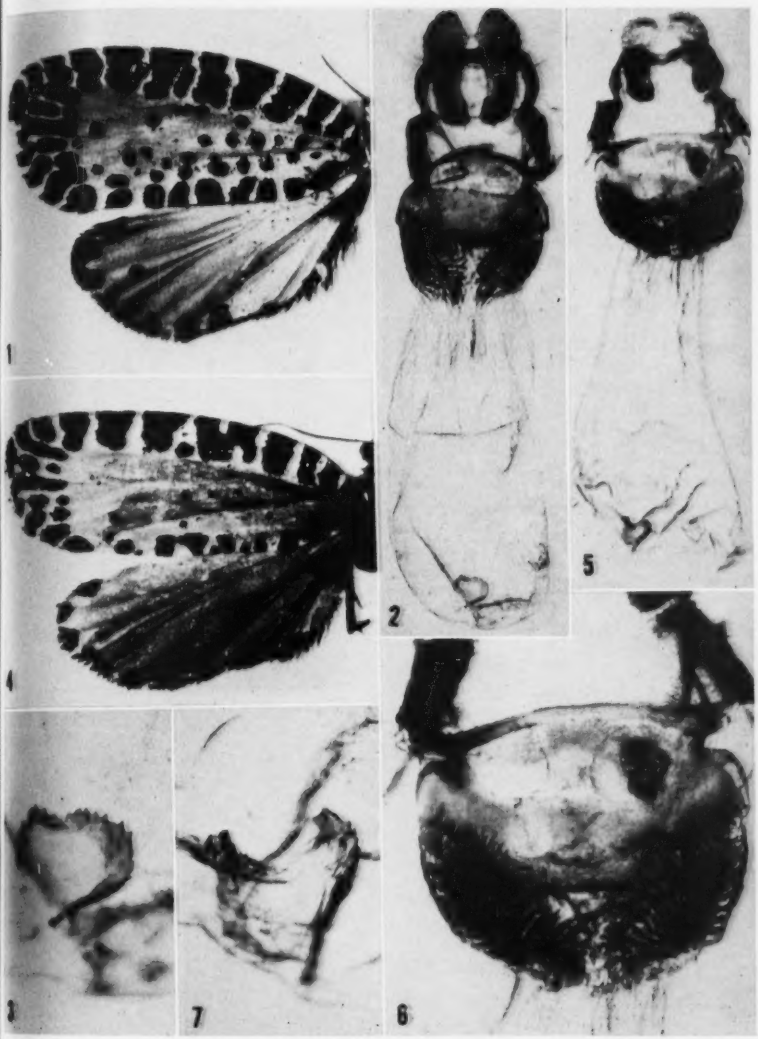
FIGURES 1–4.—*Pseudatteria heliocausta* (Dognin) form *baccheutis* Meyrick, lectotype, female: 1, left wings; 2, ventral aspect of genitalia; 3, detail of sinus vaginalis and caudal portion of bursa copulatrix; 4, signum (from Clarke, 1958).



FIGURES 1–12.—*Pseudatteria chrysanthema* (Meyrick), females: 1, Venezuela, AMNH; 2, Rio Zongo, Bolivia, 2500 ft., 1930 (slide 67-Obr., 1963), USNM. *P. splendens* (Druce): 3, female (slide 66-Obr., 1963), Ecuador, USNM; 4, female, Alcobaça, Brazil, April, USNM; 5, male, Sarayacu, Ecuador, USNM; 6, female, Alcobaça, Brazil, April, USNM; 7, same data, BM; 8, same data (slide 8681), BM. *P. volcanica volcanica* (Butler): 9, male (slide 8673), Cananche, Colombia, 1900, BM; 10, female (slide 8674), same data, BM. *P. heliocausta* (Dognin) form *baccheutis* Meyrick, females: 11, Costa Rica, 1906, BM; 12, "La Caja," Costa Rica, 1930, DEI. (1, 4–6, 8–12, left wings; 2, 3, 7, right wings, reversed images.)



FIGURES 1–6.—*Pseudatteria symplacota* Meyrick, male (slide 5-Obr., Feb. 24, 1961), Las Yungas, Bolivia, USNM: 1, left wings; 2, caudocephalic aspect of genitalia; 3, aedeagus; 4, cornutus. Male (slide 6614), same data, BM: 5, left wing. Female (slide 4430, JFGC), same data, USNM: 6, left wing.



FIGURES 1–7.—*Pseudatteria symplacota* Meyrick, females, holotype of *symplacota:* 1, left wings; 2, ventral aspect of genitalia; 3, signum. Holotype of *anemonantha* Meyrick: 4, left wing; 5, ventral aspect of genitalia; 6, detail of sinus vaginalis and caudal portion of bursa copulatrix; 7, signum (from Clarke, 1958).

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By FENNER A. CHACE, JR.

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Volume 118 1966 Number 3536

DECAPOD CRUSTACEANS FROM ST. HELENA ISLAND, SOUTH ATLANTIC

By FENNER A. CHACE, JR.
Senior Scientist, Department of Invertebrate Zoology

Introduction

As the site of Napoleon's last imprisonment and death, St. Helena is one of the best known solitary islands in the world, but much of its marine fauna has not been accorded the attention that it deserves. The island is an isolated volcanic peak 10½ miles long and 6½ miles wide, situated slightly east of the mid-Atlantic Ridge at latitude 15°58′ S. and longitude 5°43′ W. The nearest point of exposed land is Ascension Island, about 800 miles to the northwest; southern Angola, roughly 1,200 miles to the east, is the closest point on the coast of West Africa, and Recife, Brazil, approximately 2,000 miles to the west-northwest, is the nearest South American shore. That St. Helena is reasonably old and has long been isolated is suggested by its numerous endemic fishes (Cunningham, 1910, and Cadenat and Marchal, 1963), mollusks (E. A. Smith, 1890), and echinoderms (Mortensen, 1933).

Although considerable marine collecting has been done at St. Helena by Melliss, Cunningham, Mortensen, Colman, and the *Reine-*

Pokou (see Cadenat and Marchal), none of those collections, except the fishes and echinoderms, have been studied extensively. Melliss (1875) recorded the following six decapod crustaceans: *Palaemon forceps* (?=*Brachycarpus biunguiculatus*); *Palinurus*, species ? (=?*Panulirus echinatus*); *Scyllarus latus* (=*Scyllarides herklotsii*); *Pagurus bernhardus* (?=*Dardanus imperator*); *Dromia vulgaris* (=*D. erythropus*); and *Varuna atlantica* (?=*Planes cyaneus*).

Miers (1880) added *Enoplometopus dentatus* (?=*E. antillensis*) and (1881) described the apparently endemic *Pagurus imperator* (=*Dardanus imperator*).

Cunningham (1910) brought the list of known decapods to 11 with the following additions: *Pagurus arrosor* (=*Dardanus arrosor*); *Grapsus grapsus*; and *Plagusia depressa*.

A twelfth species, *Albunea guerinii* (=*A. carabus*), was cited by Stebbing (1914).

The present study was based on collections of 584 specimens received between 1958 and 1964 from Arthur Loveridge, formerly curator of herpetology at the Museum of Comparative Zoology, Harvard University, and now a resident of St. Helena. These specimens presumably represent all but 3 of the decapods previously known from the island plus 11 additional species—3 of them apparently undescribed. A major part of these collections was made by Mr. Loveridge, at considerable personal discomfort, from a buoy and its attached cable anchored in 75 meters off Rupert's Bay. The opportunity to sample this interesting assemblage of organisms was afforded once each year when the buoy was replaced; the cable was renewed every other year. The remainder of the collections was made at the few narrow breaks in the precipitous cliffs of the island where shore collecting is possible, or they were obtained from fishermen and visiting skindivers.

The Loveridge collections contain one species not included in the following systematic account, a spiny lobster represented by the dried skeleton of an abdomen found on the beach at Sandy Bay on December 22, 1959. Following my failure to identify these fragments, L. B. Holthuis pointed out their obvious similarity to the abdomen of *Panulirus homarus* (Linnaeus, 1758). As that species is reasonably common on the coast of South Africa, the fragments found at Sandy Bay might have been washed ashore from a passing ship, or they might have originated in a shipment of frozen lobster tails imported to St. Helena from South Africa. There is no reason to believe that the species belongs to the local fauna.

The three species previously recorded from St. Helena but not represented in the Loveridge collections have been included in the systematic account, in order to make the faunal list as complete as

possible at this time. As some of the records cited were published in reports that are not directly concerned with the fauna of St. Helena, however, there is a very real possibility that similar records in other papers, even of species not mentioned here, have escaped my notice.[1] The references listed for each species include the original description, all St. Helena records that have come to my attention, a good figure, and synonyms here proposed for the first time; there has been no attempt to indicate all synonyms.

Most of these collections, including holotypes of the new species, have been retained in the national collections. Available duplicate specimens, including paratypes, have been deposited in the Museum of Comparative Zoology at Harvard and in the British Museum (Natural History).

I take this opportunity to express my sincere gratitude to Mr. Loveridge for making this material available to me and for enthusiastically fulfilling my several requests for specific collections. Special thanks are also due to L. B. Holthuis of the Rijksmuseum van Natuurlijke Historie, Leiden, and to J. Forest of the Muséum National d'Histoire Naturelle, Paris, who graciously examined material in their collections at my request. Among my Smithsonian colleagues, Raymond B. Manning has been especially helpful in calling my attention to St. Helena records in the literature and in reviewing the manuscript of this report.

Family Palaemonidae

Subfamily Palaemoninae

Brachycarpus biunguiculatus (Lucas)

Palaemon biunguiculatus Lucas, 1849, p. 45, pl. 4, fig. 4.
?Palaemon forceps.—Melliss, 1875, p. 204.
Brachycarpus biunguiculatus.—Holthuis, 1952a, p. 3, pl. 1.

Material: Off Rupert's Bay; buoy; 0–2 meters; Feb. 2, 1959; 1 female.—James Bay; Sept. 7, 1959; 2 males, 1 ovigerous female.—Off Rupert's Bay; buoy and cable; 0–75 meters; Mar. 18, 1960; 3 males, 1 ovigerous female.—James Bay; collected by skindiver; April 1964; 10 females (5 ovigerous).

Measurements: Carapace lengths of males to posterior orbital margin, 4.8–11.2 mm.; of females without eggs, 4.0–7.7 mm.; of ovigerous females, 5.0–11.2 mm.

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[1] A glaring omission, brought to my attention after completion of this study, is that of *Pseudozius bouvieri* (A. Milne-Edwards, 1869). This crab was figured, but not identified, by Melliss, 1875, p. 206, pl. 22, fig. 3 (see Monod, 1956, p. 239, and Forest and Guinot, 1966, p. 68, for synonymy and distribution).

Remarks: As noted by Holthuis (1952a, p. 8), the number of fused articles in the inner antennular flagellum varies with growth. In the St. Helena material, it increases rather regularly from 5 or 6 at a carapace length of 4.0 mm. to 13 at a carapace length of 11.2 mm.

Distribution: Probably pantropical, littoral and sublittoral. The St. Helena specimens identified by Bate and recorded by Melliss (1875) as *Palaemon forceps* almost certainly belong to this species.

Subfamily Pontoniinae

Pontonia pinnophylax (Otto)

FIGURE 1

Palaemon pinnophylax Otto, 1821, p. 12.
Pontonia tyrrhena.—Schmitt, 1926, p. 40, fig. 66.

Material: James Bay; in *Pinna rudis;* Feb. 7, 1964; 1 male, 1 ovigerous female.

Measurements: Carapace length of male to posterior margin of orbit, 11.6 mm.; of ovigerous female, 13.1 mm.

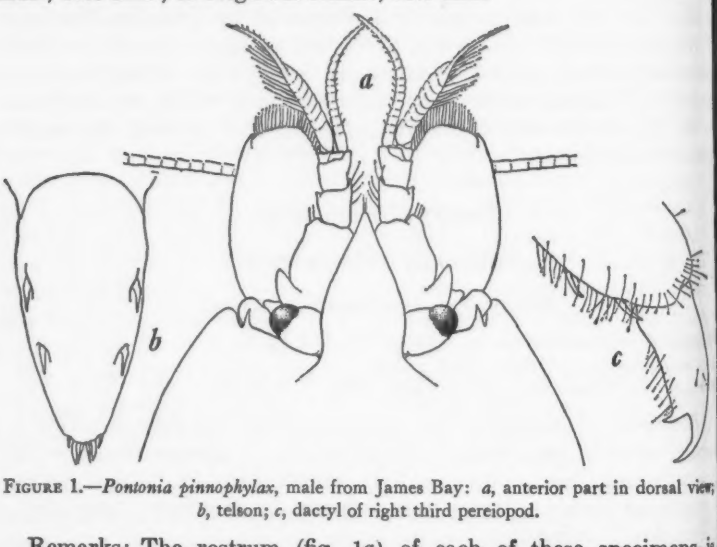


FIGURE 1.—*Pontonia pinnophylax*, male from James Bay: *a*, anterior part in dorsal view; *b*, telson; *c*, dactyl of right third pereiopod.

Remarks: The rostrum (fig. 1*a*) of each of these specimens is slightly broader and more distinctly cordiform than it is in any of the five Mediterranean and West African specimens available for comparison. Also, the dactyls of the last three pereiopods of the St. Helena specimens have the distal tooth somewhat more strongly curved (fig. 1*c*). Both of these characters are variable, however, and the present specimens probably fall within the limits of variation of *P. pinnophylax*.

Distribution: Mediterranean Sea; West Africa as far south as northern Angola; Azores; St. Helena (new record). Commensal in bivalve mollusks of the genus *Pinna*.

Family Alpheidae

Alpheus macrocheles (Hailstone)

FIGURE 2

Hippolyte macrocheles Hailstone, 1835, p. 395.
Alpheus macrocheles.—Holthuis, 1951, p. 69.

Material: Off Rupert's Bay; buoy; 0–2 meters; Feb. 11, 1963; 1 ovigerous female.—James Bay; collected by skindiver; April 1964; 1 ovigerous female.

Measurements: Carapace lengths to base of rostrum, 5.1 and 7.2 mm.

Remarks: The smaller specimen bears only two or three eggs, suggesting that it is a very young adult. In the proportions of the antennular peduncle and last three pereiopods and in the length of the distal spine on the attenal scale, the larger specimen resembles two much larger British specimens of *A. macrocheles* available for comparison more closely than does the smaller one, but the detached minor chela associated with the larger St. Helena specimen is much slenderer and has a more pronounced dorsal notch than noted in the British specimens. Comparison of this appendage with those of typical specimens of *A. macrocheles* of similar size would be desirable.

Distribution: The recorded range of *A. macrocheles* extends from the south coast of England to the Cape Verde Islands and Guinea, including the Mediterranean, usually in depths of from 20 to more than 100 meters. The western Atlantic records of this species in Rathbun (1901) and Schmitt (1935) are based on fragmentary specimens and require verification.

Alpheus paragracilis Coutière

Alpheus paragracilis Coutière, 1897, p. 304; 1905, p. 883, pl. 76, figs. 22–22g.
Crangon paragracilis.—Banner, 1953, p. 96, fig. 33.

Material: Off Rupert's Bay; buoy cable; 0–75 meters; Jan. 17, 1958; 2 females.—Same; Mar. 18, 1960; 1 female with two major chelae.—Same; Apr. 5, 1962; 1 male.—James Bay; collected by skindiver; April 1964; 1 ovigerous female.

Measurement: Carapace length of male to base of rostrum, 4.4 mm.; of females without eggs, 4.3–5.2 mm.; of ovigerous female, 5.9 mm.

Remarks: Although this species has not been recorded from the Atlantic heretofore, no differences could be found between the St. Helena specimens and material of *A. paragracilis* from the Hawaiian Islands, with which they were compared.

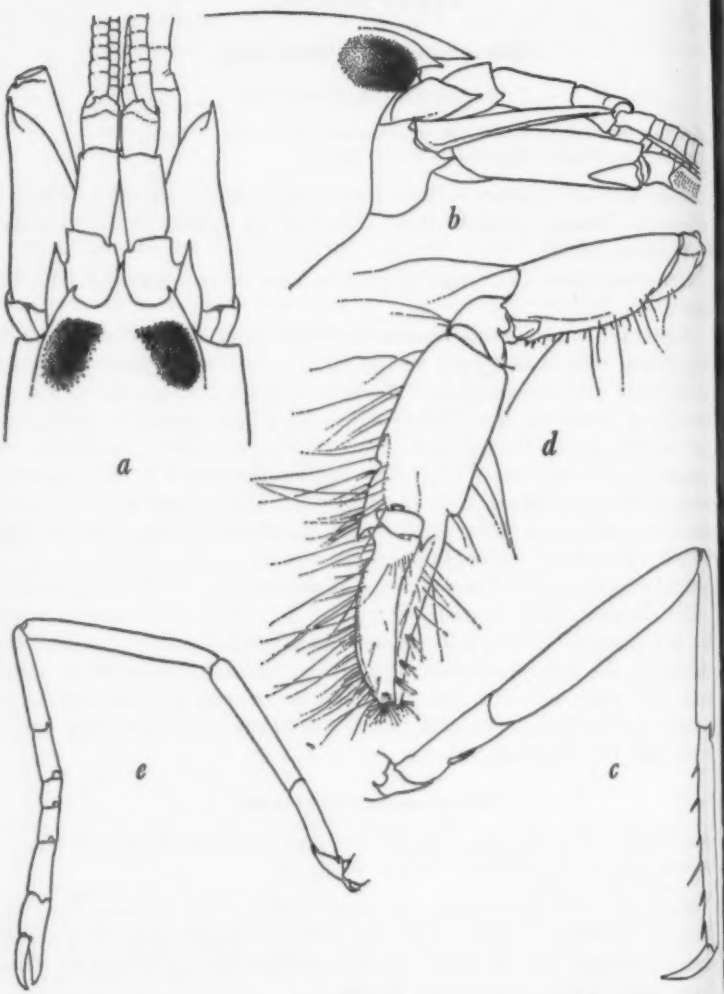


FIGURE 2.—*Alpheus macrocheles:* *a*, anterior part of smaller ovigerous specimen in dorsal view; *b*, same in lateral view; *c*, right third pereiopod of same specimen; *d*, minor chelipeds associated with larger ovigerous female; *e*, left second pereiopod of larger specimen.

Distribution: Indo-Pacific region from the Red Sea and Madagascar to the Hawaiian Islands, littoral and sublittoral; St. Helena (new Atlantic record).

Synalpheus fritzmuelleri Coutière

Synalpheus fritzmülleri Coutière, 1909, p. 35, fig. 18.

Material: Off Rupert's Bay; buoy cable; 0–75 meters; Jan. 17, 1958; 1 male, 5 females (4 ovigerous).—Same; buoy; 0–2 meters; Feb. 2, 1959; 1 male, 2 ovigerous females.—Same; buoy and cable; 0–75 meters; Mar. 18, 1960; 5 males, 20 females (11 ovigerous), 1 mutilated specimen.—Same; Apr. 5, 1962; 3 ovigerous females.—Same; buoy; 0–2 meters; Feb. 11, 1963; 2 females.—James Bay; collected by skindiver; April 1964; 1 male, 14 females (11 ovigerous).

Measurements: Carapace lengths of males to base of rostrum, 3.2–6.1 mm.; of females without eggs, 3.4–8.8 mm.; of ovigerous females, 4.8–8.8 mm.

Remarks: The St. Helena material agrees very well with the syntype series of *S. fritzmuelleri*, with which it has been compared. Two or three of the specimens are of the "oxyceros" form called *S. fritzmuelleri elongatus* by Coutière (1909), but most of them are of the typical form.

As in *S. senegambiensis* (see Holthuis, 1951, p. 93), the males lack both an appendix masculina and an appendix interna on the endopod of the second pleopod. In some of the specimens identified as females, however, the appendix interna is so slender that it is distinguishable only with difficulty from the setae fringing the endopod.

Distribution: St. Helena (new record); western Atlantic from North Carolina and Bermuda to Santa Catarina, Brazil; Baja California. Littoral to more than 50 meters. The record of this species from Greenland waters (Stephensen, 1950) is very questionable.

Family Palinuridae

Panulirus echinatus Smith

FIGURES 3, 4; PLATES 1, 2

Panulirus echinatus Smith, 1869, p. 20.—Holthuis, 1961, p. 223, fig. 1a.
Palinurus species?—Melliss, 1875, p. 204.
Panulirus guttatus.—Cunningham, 1910, p. 120.
Palinurus guttatus.—Colman, 1946, p. 277.

Material: James Bay; Jan. 29, 1964; 1 ovigerous female.

Measurements: Carapace length in midline, 101 mm.

Remarks: The uninterrupted transverse grooves on all but the first abdominal somites of this specimen caused me to believe at first that it represented an undescribed, possibly endemic species. The subsequent discovery in the national collections of a large male from

the Cape Verde Islands, with similarly complete abdominal grooves, led to correspondence with J. Forest at the Muséum National d'Histoire Naturelle in Paris and the disclosure that Cape Verde specimens of *P. echinatus* are variable in this regard. The somewhat larger light spots on the abdomen of the St. Helena specimen and the broader light stripes on the legs may eventually prove to be of sub-

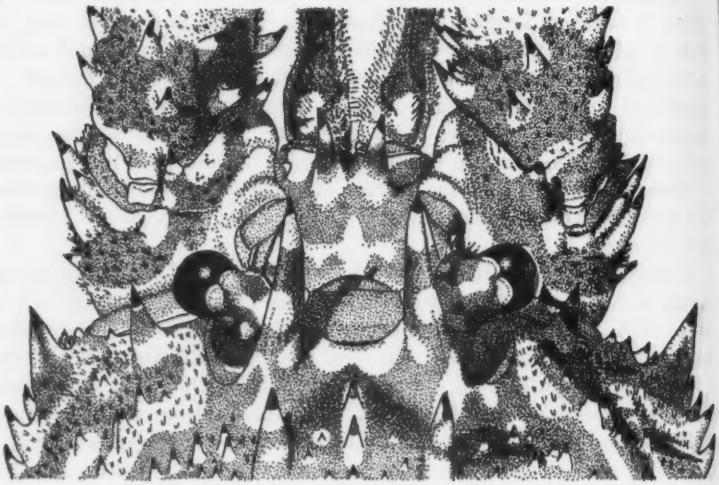


FIGURE 3.—*Panulirus echinatus*, frontal region of ovigerous female from James Bay.

specific significance, but that conclusion must await the study of series of *P. echinatus* from various parts of its range.

The species is known at St. Helena as the "long-legs," where it is of some local commercial importance, but it is not taken as frequently as the "stump" (*Scyllarides herklotsii*).

Distribution: Cape Verde Islands; St. Peter and St. Paul Rocks; St. Helena; Brazil. Sublittoral.

Family Scyllaridae

Scyllarides herklotsii (Herklots)

FIGURE 5

Scyllarus Herklotsii Herklots, 1851, p. 14, pl. 2, figs. 14, 15.
Scyllarus latus.—Melliss, 1875, p. 203.—Cunningham, 1910, p. 119.—Colman, 1946, pp. 275, 277.
?*Scyllarides elisabethae*.—Stebbing, 1914, pp. 255, 282.
Scyllarides herklotsi.—Holthuis, 1952b, p. 23, fig. 6.

Material: Off Rupert's Bay; buoy; 0–2 meters; Feb. 2, 1959; 1 postlarva (pseudibacus stage).—James Bay; fish market; December

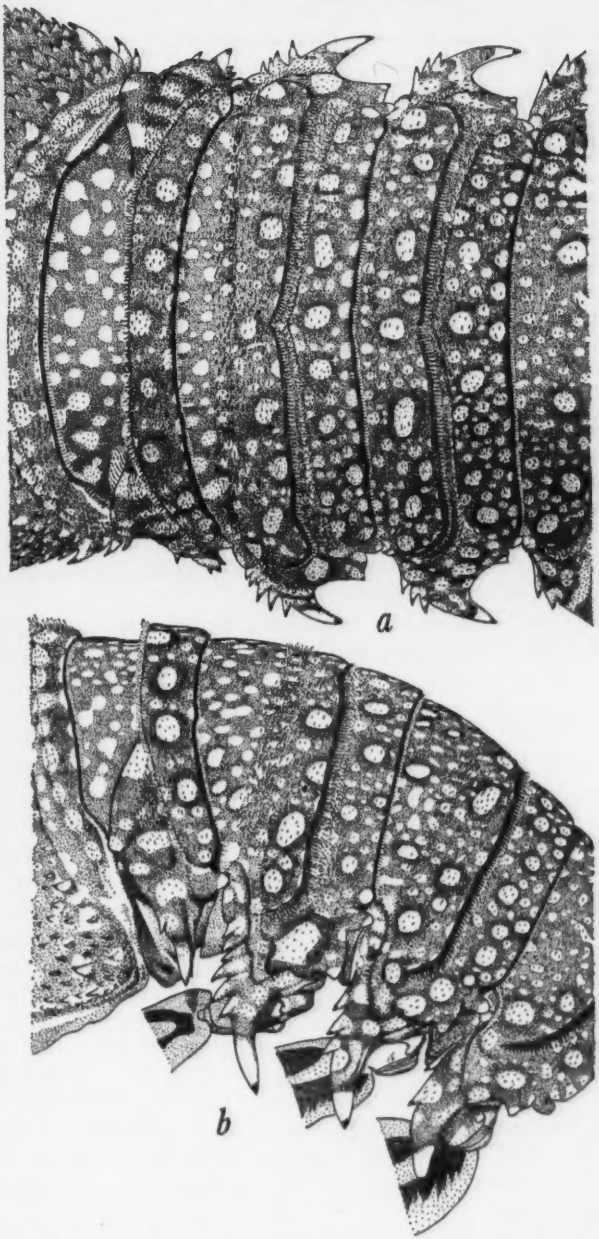


FIGURE 4.—*Panulirus echinatus*, first three abdominal somites of ovigerous female from James Bay: *a*, dorsal view; *b*, lateral view.

1960; 1 dried female.—James Bay, Jamestown Jetty; Feb. 1, 1962; 2 dried males.

Measurements: Carapace lengths of males to midpoint of imaginary line joining inner orbital angles, 77 and 94 mm.; of female, 100 mm.; of postlarva, 15 mm.

Remarks: This species, known on St. Helena as the "stump," supports a local fishery (see Cunningham and Colman references).

There has been no opportunity to compare these specimens with West African material, but they differ from the Mediterranean *Scyllarides latus* in the characters noted by Holthuis (1952b). Stebbing's record of *S. elisabethae* from "Off St. Helena harbour, between 45 and 55 fathoms; June 2, 1904" is puzzling. It seems unlikely that a person of Stebbing's ability and experience would confuse *S. herklotsii* (which has subrectangular anterolateral angles and a shallow notch in the lateral margin of the carapace) with the South African species (which apparently has acute and outstanding anterolateral angles and correspondingly pronounced indentations behind them). I considered the chance that "St. Helena harbour" might refer to Saint Helena Bay, South Africa, but the fact that the date corresponds with that of collections of *Albunea* and *Grapsus* from James Bay, St. Helena Island, seems to rule out that possibility.

Although it has been well established that the species assigned to the genus *Pseudibacus* are postlarvae of *Scyllarides* (see Bouvier, 1917, p. 101), these stages are not yet well known, and their identity with the respective adult forms remains to be verified in most cases. I have therefore illustrated the pseudibacus stage (fig. 5) found on the buoy off Rupert's Bay. This specimen was evidently about to metamorphose when collected. It agrees with the rather brief description of the Mediterranean *Pseudibacus veranyi* Guérin-Méneville, 1855 (which is almost certainly the postlarva of *Scyllarides latus*), but there is little similarity between the St. Helena example and Guérin-Méneville's obviously inaccurate figure. Both *Pseudibacus gerstaeckeri* Pfeffer, 1881, from the western South Atlantic [which Bouvier tentatively assigned to *Scyllarides aequinoctialis* (Lund)], and *P. pfefferi* Miers, 1882, from Mauritius [which may be the postlarva of *S. squamosus* (H. Milne Edwards)], seem to differ from the St. Helena specimen in having a distinct median carina on the carapace. In the postlarva figured by Barnard (1950, p. 559, figs. 104g–k), the anterolateral angles are more outstanding, as might be expected of *S. elisabethae*. Probably direct comparison of the pseudibacus stages of *S. latus* and *S. herklotsii* will be necessary to determine whether there is postlarval evidence to support the belief that the two forms are specifically distinct.

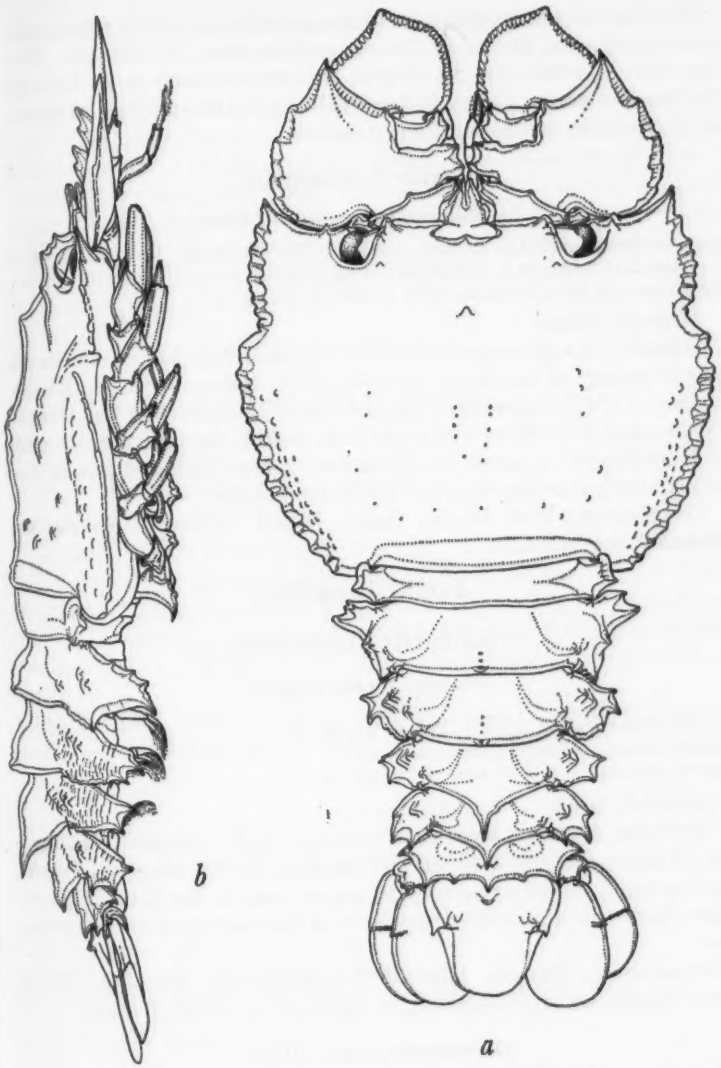


FIGURE 5.—*Scyllarides herklotsii*, pseudibacus stage from Rupert's Bay buoy: *a*, dorsal view; *b*, lateral view.

Distribution: *S. herklotsii* has been recorded previously from only three specimens, two from Ghana and one from the Congo. Presumably, however, the St. Helena material referred to *S. latus* by Melliss, Cunningham, and Colman belongs to this species. It apparently occurs in depths of 25 to 70 meters.

Family Nephropidae

Enoplometopus antillensis Lütken

Enoplometopus antillensis Lütken, 1865, p. 265.—Holthuis, 1946, p. 79, pl. 5, figs. b, d, e, g, h, j, k, l; pl. 6, figs. a–e; pl. 7, figs. a, b.
Enoplometopus dentatus Miers, 1880, p. 381, pl. 15, fig. 7.

Material: None.

Remarks: *Enoplometopus dentatus* was described from a mutilated, poorly preserved specimen collected at St. Helena by J. C. Melliss. Holthuis (1946) suggested, with considerable justification but without reexamination of Miers' type-specimen, that *E. dentatus* is a synonym of *E. antillensis*, a species described from a West Indian specimen and subsequently discovered in the Indonesian region.

Distribution: West Indies; Banda Island, Moluccas; St. Helena. Probably sublittoral.

Family Paguridae

Subfamily Dardaninae

Dardanus arrosor (Herbst)

Cancer arrosor Herbst, 1796, p. 170, pl. 43, fig. 1.
Pagurus arrosor.—Cunningham, 1910, p. 121.
Dardanus arrosor.—Forest, 1955, p. 90, fig. 19.

Material: None.

Remarks: Although there is no reason to doubt Calman's identification of the specimens collected and reported by Cunningham (1910), that material should eventually be reexamined in the light of knowledge about this and related species that has accumulated since that date.

Distribution: Eastern Atlantic, Mediterranean, Red Sea, Philippines, Japan, and New Zealand, in depths of 20 to 300 meters.

Dardanus imperator (Miers)

?*Pagurus bernhardus*.—Melliss, 1875, p. 203.
Pagurus imperator Miers, 1881, p. 275.—Cunningham, 1910, p. 120, fig. 6.
Dardanus imperator.—Forest, 1955, p. 90.

Material: James Bay, West Rocks; Dec. 21, 1959; 1 juvenile.

Measurements: Total length of carapace in midline, 4.8 mm.; length of anterior portion of carapace, 2.6 mm.

Remarks: This immature specimen differs from Miers' description of *D. imperator* in a few characters. The frontal margin is deeply sinuous, rather than "nearly straight," and it is armed with a slender spine directed anterolaterally just lateral to the base of each eyestalk. The ocular scales each terminate in two divergent spines (the outer one slightly stouter than the inner) rather than being "denticulated on their outer margins." Also, there are no calcareous plates on the anterior abdominal somites. These differences may be merely characteristic of subadult individuals.

Distribution: Known only from St. Helena, to a depth of at least 25 meters.

Family Albuneidae

Albunea carabus (Linnaeus)

Cancer Carabus Linnaeus, 1758, p. 632.
Albunea guerinii.—Stebbing, 1914, pp. 255, 281.
Albunea carabus.—Monod, 1956, p. 40, figs. 10–14.

Material: None.

Remarks: There is nothing in Stebbing's remarks about the specimen collected by the *Scotia* at "James Bay, St. Helena, June 2, 1904; Station 499" to suggest that it is other than *A. carabus*, but reexamination of the specimen would be desirable because of the information that has been gained about the species of *Albunea* during the past 50 years.

Distribution: Mediterranean; West Africa as far south as Ghana; St. Helena. Sublittoral.

Family Dromiidae

Dromia erythropus (George Edwards)

FIGURE 6

Cancer erythropus George Edwards, 1771.
Dromia lator H. Milne Edwards, 1837, p. 174.
Dromia vulgaris.—Melliss, 1875, p. 203.—Cunningham, 1910, p. 122.
Dromia erythropus.—Rathbun, 1937, p. 31, fig. 11, pl. 6, figs. 1, 2.
Dromia species?—Colman, 1946, p. 277.

Material: Off Rupert's Bay; buoy and cable; 0–75 meters; Mar. 18, 1960; 1 young female.—Off Jamestown; collected by fisherman; 1 dried male, 1 dried female.—James Bay; collected by skindiver; February 1964; 1 male, 1 female.

Measurements: Carapace lengths of males in midline, 62.8 and 67.1; of females, 14.6–57.2 mm.

Remarks: The four adult specimens agree with western Atlantic material with which they have been compared and disagree with specimens of *D. personata* (Linnaeus, 1758) [=*D. vulgaris* H. Milne Edwards, 1837, see Holthuis and Gottlieb, 1958, p. 78] in the more evenly convex carapace and the more prominent suborbital tooth mentioned by Milne Edwards. The two adult males and one of the adult females differ from all western Atlantic adults at my disposal, however, in having the third anterolateral tooth (not counting the orbital angle) placed so close to the second tooth as to form almost a single bifid tooth (compare fig. 6 with Rathbun 1937, fig. 11). Evaluation of the systematic importance of this character must await the examination of additional specimens. The immature specimen lacks the third anterolateral tooth entirely, but it differs little in this respect from western Atlantic specimens of *D. erythropus* of comparable size.

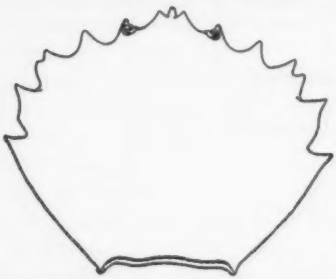


FIGURE 6.—*Dromia erythropus*, outline of denuded carapace of male from off Jamestown.

Distribution: Florida to Brazil; Bermuda; St. Helena. Sublittoral to 360 meters.

Family Calappidae

Subfamily Calappinae

Calappa gallus (Herbst)

Cancer gallus Herbst, 1803, pp. 18, 46, pl. 58, fig. 1.
Calappa gallus.—Monod, 1956, p. 100, figs. 115, 116.

Material: No exact locality; November 1963; 1 female.

Measurements: Carapace length in midline, 49.2 mm.

Distribution: Western Atlantic from Florida to Brazil; Bermuda; St. Helena (new record); eastern Atlantic from Senegal to Angola; Indo-Pacific region from East Africa (Red Sea to Port Shepstone, South Africa) to Hawaii. Sublittoral to 218 meters.

Family Xanthidae

Actaea margaritaria A. Milne-Edwards

Actaea margaritaria A. Milne-Edwards, 1867, p. 41, pl. 21 bis, figs. 3–6.—Odhner, 1925, p. 47, pl. 3, fig. 8.
Actaea (*Actaea*) *margaritaria*.—Monod, 1956, p. 294, figs. 357–360.

Material: Off Rupert's Bay; buoy; 0–2 meters; Feb. 2, 1959; 1 male, 1 female.—Same; buoy and cable; 0–75 meters; Mar. 18, 1960; 1 male, 4 females.—Same; Apr. 5, 1962; 1 female.—Same; buoy; 0–2 meters; Feb. 11, 1963; 3 females.—James Bay; collected by skin-diver; April 1964; 2 males, 2 females (1 ovigerous).

Measurements: Carapace lengths of males, 3.1–5.3 mm.; of females without eggs, 3.2–7.3 mm.; of ovigerous female, 8.7 mm.

Remarks: The smallest male and six of the eleven females (with carapaces less than 5 mm. long) are evidently immature.

The male gonopods of this species resemble those of *A. ruppellii* (Krauss, 1843) from South Africa and the Indo-Pacific region, but I cannot accept Odhner's suggestion that *A. margaritaria* may be only subspecifically distinct from that species. Not only does *A. ruppellii* attain a much greater size than has been recorded for *A. margaritaria*, but it is a much hairier crab, and the dark color of the fixed finger extends over somewhat less of the surface of the male chela than it does in the Atlantic species.

Distribution: Off West Africa from the Cape Verde Islands to Annobon; St. Helena (new record). Sublittoral to 100 meters.

Micropanope melanodactylus (A. Milne-Edwards)

FIGURE 7

Xanthodes melanodactylus A. Milne-Edwards, 1867, p. 39, pl. 21 bis, figs. 1, 2.
Micropanope polita Rathbun, 1893, p. 238.—Garth, 1946, p. 459, pl. 77, fig. 4.
Panopeus tanneri Faxon, 1893, p. 154.
Micropanope melanodactyla.—Monod, 1956, p. 320, figs. 401–405.

Material: Off Rupert's Bay; buoy cable; 0–75 meters; Apr. 5, 1962; 1 male.—Same; buoy; 0–2 meters; Feb. 11, 1963; 2 males.

Measurements: All three specimens have carapace lengths of 4.0 mm.

Remarks: Comparison of homeotypes of *Xanthodes melanodactylus* from the Cape Verde Islands with syntypes of *Micropanope polita* Rathbun from the eastern Pacific off Baja California and a syntype of *Panopeus tanneri* Faxon from near Cocos Island has disclosed no apparently significant differences in the form of the gonopods (fig. 7) or in any other characters that cannot be referred to normal variation in this variable species. Garth (1946, p. 462) noted that the 800

specimens examined by him from the Galapagos Islands exhibited "almost infinite variation." This variability is especially disconcerting in the form of the merus of the outer maxillipeds; that segment may be either subquadrate or markedly produced at the distolateral angle in specimens from the same general area. On the other hand, the prolongation of the posterolateral angles of the penultimate abdominal somite of the male and the form of the gonopods seem to

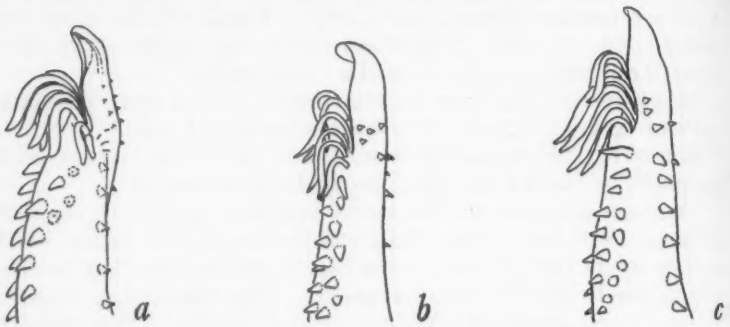


FIGURE 7.—*Micropanope melanodactylus*, laterocephalic aspects of right gonopods: *a*, homoeotype with carapace length of 6.1 mm. from roadstead of Porto Grande, St. Vincent; *b*, syntype of *Micropanope polita* with carapace length of 5.3 mm.; *c*, syntype of *Panopeus tanneri* with carapace length of 6.0 mm.

be reliable diagnostic characters. Intensive study of material from the eastern Atlantic and the eastern Pacific may eventually disclose differences of subspecific importance, but it seems best for the present to consider the two populations identical.

It is remarkable that this species, which is abundant in the eastern Atlantic and the eastern Pacific, is apparently absent from the western Atlantic. None of the species described from eastern America have gonopods that could be confused with those of *M. melanodactylus*. *M. truncatifrons* Rathbun, 1898, which is known from only two females and one juvenile from off Cuba and off Yucatan, bears a superficial resemblance to *M. melanodactylus*, but I believe that it is a distinct species; in both adult females, the front is straighter, the outer surfaces of the palms are more completely granular, and the color on the fingers is less extensive than in any specimens of *M. melanodactylus* examined.

I agree with Monod (1956, p. 324) that *M. melanodactylus* is probably not a synonym of *Xantho minor* Dana, 1852b. Unfortunately, the type-specimen of Dana's species is probably no longer extant, and his name is therefore likely to remain a *nomen dubium* indefinitely.

Distribution: West Africa (Gambia to Angola); Cape Verde Islands; St. Helena (new record); Baja California, Mexico (Bahia Magdalena and Cabo de San Lucas); Cocos Island; Galapagos Islands. Sublittoral to 225 meters.

***Micropanope rufopunctata* (A. Milne-Edwards)**

FIGURE 8

Xanthodes rufopunctatus A. Milne-Edwards, 1869, p. 409.
Pilumnus granulimanus Stimpson, 1871, p. 143.
Micropanope granulimanus.—Rathbun, 1930, p. 439, pl. 180, figs. 1, 2.
—Chace, 1956, p. 156.
Micropanope rufopunctata.—Monod, 1956, p. 313, figs. 386–392.

Material: Off Rupert's Bay; buoy cable; 0–75 meters; Jan. 17, 1958; 3 males, 1 ovigerous female.—Same; buoy; 0–2 meters; Feb. 2, 1959; 1 male, 1 young female.—Same; buoy and cable; 0–75 meters; Mar. 18, 1960; 12 males, 10 females.—Same; Apr. 5, 1962; 2 males, 5 females (1 ovigerous).—Same; buoy; 0–2 meters; Feb. 11, 1963; 1 young female.—James Bay; collected by skindiver; April 1964; 8 males, 6 females (2 ovigerous).

FIGURE 8.—*Micropanope rufopunctata*, cephalic aspects of right gonopods: *a*, specimen with carapace length of 5.8 mm. from Rupert's Bay buoy and cable; *b*, specimen with carapace length of 5.4 mm. from Caracas Bay, Curaçao; *c*, syntype of *Xanthodes granosus* with carapace length of 6.3 mm. from La Praya, Cape Verde Islands.

Measurements: Carapace lengths of males 2.5–5.8 mm.; of females without eggs, 2.8–7.0 mm.; of ovigerous females, 4.0–6.2 mm.

Remarks: There is little doubt that the specimens from the Bahamas and Curaçao that were identified by Rathbun (1930) as *Micropanope granulimanus* (Stimpson) belong to this species (compare figure 8*b* of the gonopod of a Curaçao specimen with figure 392 in

Monod, 1956, of a probably syntype of *Xanthodes rufopunctatus* from the Cape Verde Islands). Also, Monod is probably correct in synonymizing *Xanthodes granosus* A. Milne-Edwards and Bouvier, 1898, with this species. Monod noted that there were five subapical hooked spines on the gonopod of the syntype of *X. granosus* examined by him, whereas he found only four in what he believed to be type-material of *X. rufopunctatus*. The syntype of *X. granosus* in the collections of the U.S. National Museum, however, has only four hooked spines (fig. 8*c*), whereas the gonopod of the Curaçao specimen (fig. 8*b*), which otherwise closely resembles Monod's figure of the syntype of *X. rufopunctatus*, has five such spines.

Distribution: Eastern Mediterranean (Alexandria); Ghana; Azores; Canary Island; Cape Verde Islands; St. Helena (new record); Bahamas; Cuba; Curaçao; Islas Los Roques. Sublittoral to at least 30 meters.

Family Grapsidae

Subfamily Grapsinae

Grapsus grapsus (Linnaeus)

Cancer grapsus Linnaeus, 1758, p. 630.
Grapsus grapsus.—Cunningham, 1910, p. 122.—Monod, 1956, p. 407, fig. 561.
Grapsus maculatus.—Stebbing, 1914, pp. 254, 265.
Grapsus.—Colman, 1946, p. 271.

Material: James Bay; West Rocks; Sept. 6, 1958; fragments of cast shell of 1 male.—Rupert's Bay; Sept. 8, 1958; fragments of cast shell of 1 young male.—James Bay, West Rocks; Dec. 21, 1959; 1 young soft-shelled male (prey of sea anemone), cast shell of 1 young male.—Sandy Bay; rocks; Dec. 22, 1959; cast shell of 1 young female.—James Bay; Apr. 6, 1962; 1 dried male.—James Bay; from pool at West Rocks; June 10, 1963; 1 ovigerous female.—James Bay, West Rocks; June 14, 1963; 1 juvenile.

Measurements: Carapace lengths of males, about 15–54 mm.; of young female, 19.3 mm.; of ovigerous female, 40+ mm.; of juvenile, about 12 mm.

Distribution: Tropical and subtropical shores of the eastern and western Atlantic and the eastern Pacific. On rocks at and above tide level. A closely related species, *G. tenuicrustatus* (Herbst, 1783), inhabits the Indo-Pacific region.

Pachygrapsus loveridgei, new species

FIGURES 9, 10

Material: Off Rupert's Bay; buoy cable; 0–75 meters; Jan. 17, 1958; 5 males, 8 females (5 ovigerous), 1 intersex.—Same; buoy; 0–2

meters; Feb. 2, 1959; 10 males, 12 females (7 ovigerous).—Same; buoy and cable; 0–75 meters; Mar. 18, 1960; 31 males, 38 females (16 ovigerous), 2 juveniles [1 male is holotype, USNM 112457].—Same; Apr. 5, 1962; 23 males, 16 females (2 ovigerous), 2 juveniles.—Same; buoy; 0–2 meters; Feb. 11, 1963; 28 males, 35 females (18 ovigerous).—James Bay; collected by skindiver; February 1964; 1 female.—Same; April 1964; 6 males, 12 females (2 ovigerous).

Description: Carapace from one-fifth to one-third broader than long at all sizes. Surface evenly convex and covered with transverse striae, those on gastric and hepatic regions granulate and crowded, those on cardiac and intestinal regions fainter and sparser. Lateral margins slightly arched, strongly convergent posteriorly, and armed with an outstanding, acute tooth posterior to similar, but larger,

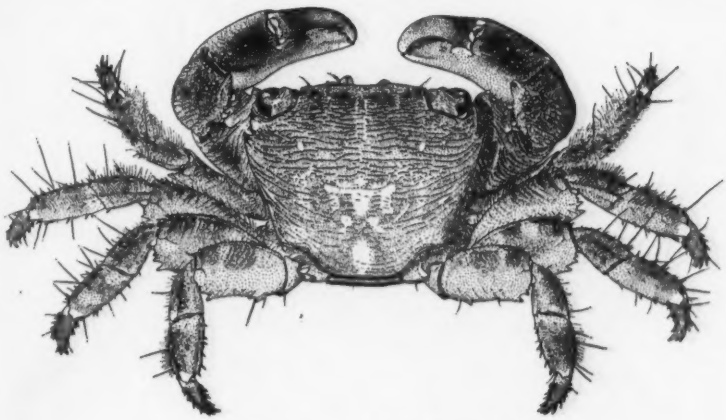


FIGURE 9.—*Pachygrapsus loveridgei*, male holotype.

outer orbital tooth. Median postfrontal lobes distinct and transverse, outer pair less prominent and slanting obliquely toward outer angle of front. Front slightly more than half as wide as carapace, anterior margin sinuous and granulate, faintly convex on both sides between shallow median and lateral sinuses, lateral margins converging anteriorly, surface with prominent granulate ridge behind each lobe and shorter, fainter striae elsewhere. Orbits oblique, about two-fifths as wide as front, lower border distinctly denticulate and separated by narrow notch from outer orbital tooth.

Chelipeds equal, merus and carpus transversely striated. Inner lobe of merus denticulate, with large and small notch at distal end forming three teeth. Carpal tooth blunt. Chelae robust; upper margin of palm with several oblique striae bearing a few small, pearly

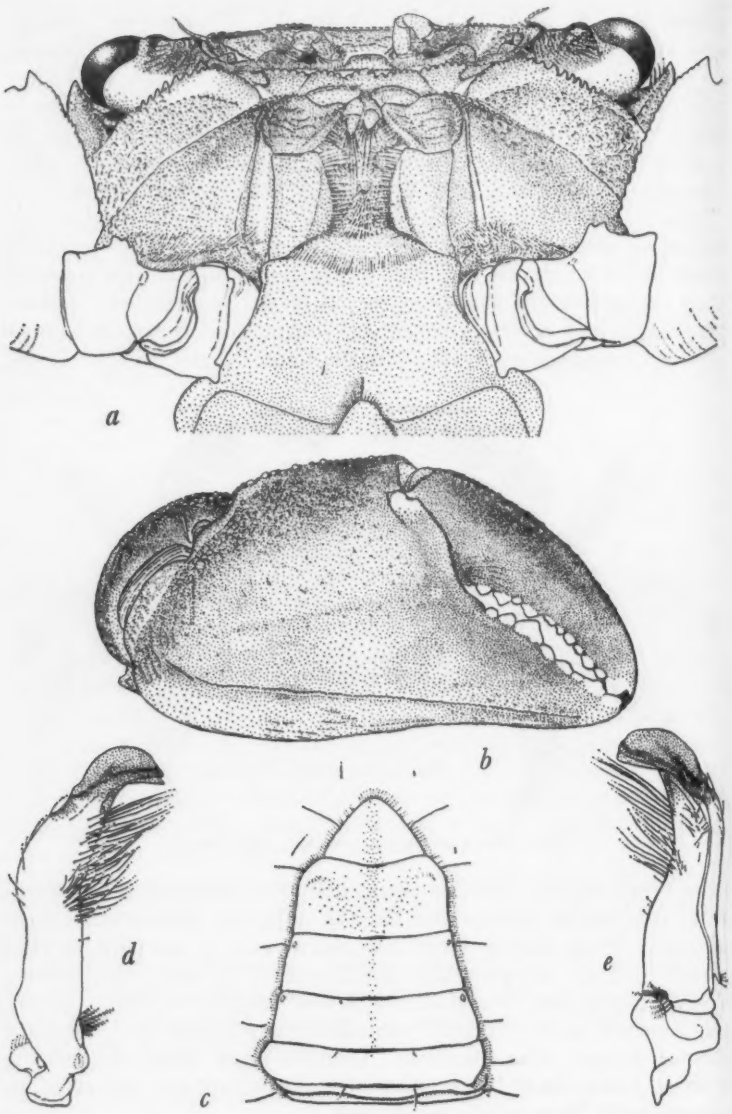
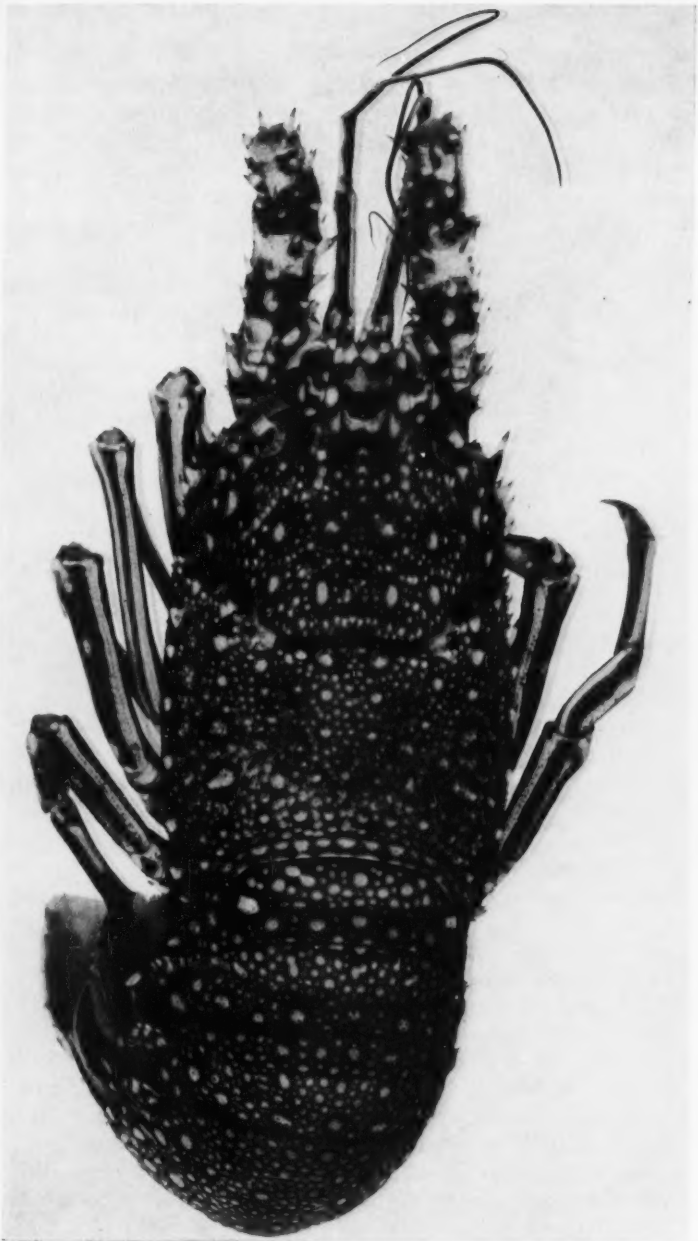


FIGURE 10.—*Pachygrapsus loveridgei*, male holotype: *a*, suborbital and buccal regions; *b*, outer surface of right chela; *c*, abdomen; *d*, left gonopod, caudal aspect; *e*, same, cephalic aspect.



Panulirus echinatus, dorsal view of ovigerous female from James Bay.

Panulirus echinatus, lateral view of ovigerous female from James Bay.

tubercles, but without continuous marginal line dividing outer and inner faces; distinct longitudinal line running nearly entire length of outer surface of propodus near lower margin; palm about one and one-half times as high as length of superior surface; movable finger longer than height of palm; fingers narrowly gaping, except where interrupted by large, triangular tooth near middle of fixed finger; inner surface of palm very faintly rugose, with stronger striae near upper and lower margins. Merus of walking legs with small, subdistal spine on dorsal margin and with two or three triangular teeth at distal end of posterior margin; plumose setae covering much of anterior surfaces of carpus and propodus of first leg, becoming progressively sparser on second and third legs, and absent from last leg; second and third legs subequal, one and three-fourths times as long as carapace; first and fourth pairs subequal, shorter.

Terminal somite of male abdomen broadly triangular, with faintly sinuous margins (somewhat foreshortened in figure); margins of penultimate somite diverging slightly before converging strongly to distal margin. Broadly sickle-shaped end pieces of gonopods showing faintly through appressed abdomen.

Color: In ethyl alcohol, carapace mottled grayish brown, with all transverse striae dark brown; chelipeds dark reddish brown dorsally, fading to light tan on outer surface of palm and to nearly white near tips of fingers; walking legs mottled with brown, gray, and tan, proximal and distal ends of propodus and proximal end of dactyl nearly white, giving banded appearance to legs; conspicuous whitish patches on both sides of dactyl of chelipeds and walking legs, near tips of fingers of chelipeds, on lower surface of eyestalks, and at both ends of epistome at junction with inner end of lower margin of orbit.

Measurements: Carapace of male holotype, 10.3 mm. long, 13.1 mm. wide. Carapace lengths of male paratypes, 3.7–12.0 mm.; of females without eggs, 3.1–10.7 mm.; of ovigerous females, 3.2–12.4 mm.

Remarks: The general appearance of this crab, including the sinuous front and the plumose setae on the anterior surfaces of the first walking legs (noted by Holthuis, 1959, p. 240), is very similar to that of *Pachygrapsus transversus* (Gibbes, 1850). Comparison of St. Helena material with specimens of *P. transversus* from the eastern and western Atlantic and the eastern Pacific shows that *P. loveridgei* differs in having the dorsal surface of the carapace inflated and evenly convex, rather than flattened or depressed on the cardiac region; in having the transverse striae on the anterior half of the carapace more numerous and crowded; in lacking the longitudinal crenulate line that extends over the entire length of the upper surface of the palm in *P. transversus;* and in having the chitinous terminal portion of the

Panulirus echinatus, lateral view of ovigerous female from James Bay.

gonopods broadly sickle shaped, rather than obliquely T-shaped (see fig. 11*h*).

The genus *Pachygrapsus* is in need of intensive study and possible revision. As a contribution toward such a review, illustrations are offered in figure 11 of the gonopods of the described species in the national collections. Whenever possible, topotypic males have been selected. This study has demonstrated the importance of the gonopods at the species level in this genus. It has confirmed that *Sesarma murrayi* Calman, 1909, is identical with *Pachygrapsus minutus* A. Milne-Edwards, 1873 (see Schmitt, 1939, p. 22) and that *P. longipes* Rathbun, 1893, is a synonym of *P. planifrons* De Man, 1888 (see Edmondson, 1959, p. 175); the latter species seems to attain a somewhat larger size in Hawaiian waters than it does in Indonesia, but the gonopods are identical. How important the gonopods are at the generic level remains to be demonstrated. Those examined fall into two categories. One group [*P. crassipes* Randall, 1839; *P. gracilis* (De Saussure, 1858); *P. marmoratus* (Fabricius, 1787); *P. maurus* (Lucas, 1849); and *P. minutus*] has a dense brush of stout, amber setae which completely conceals the tip of the appendage. The other group [*P. loveridgei; P. planifrons; P. plicatus* (H. Milne Edwards, 1837); and *P. transversus*] bears more slender, longer setae which do not cover the chitinous end-piece. Attempts to relate these differences to other morphological characters have not been entirely successful. A cursory examination of the species available to me, however, shows a possible correlation between the two groups of species and the presence or absence of the conspicuous, but delicate, brush of plumose setae on the anterior surface of the first pair of walking legs. Such a brush was found in *P. loveridgei*, *P. minutus*, *P. plicatus*, and *P. transversus*. Although *P. minutus* is placed in the first group of species above (which otherwise lack plumose setae on the first walking legs), it might be assigned to either group; the endpiece of the gonopod is hidden by a few stout setae, but it does not project at an angle to the axis of the appendage as it does in the other species of that group. Also, the brush of setae was not observed in any of the available specimens of *P. planifrons*, a species that seems to belong to the second group on the basis of its gonopod. These setae are frequently lost in museum specimens, however; it would be important to know if they are present in fresh material of this species. A detailed study of the gonopods of all species of the family Grapsidae might yield worthwhile information on generic relationships.

Distribution: *P. loveridgei* is known only from St. Helena. It will be noticed that 85 of the 211 specimens were found on the buoy alone and were therefore living at or near the surface; it is not known

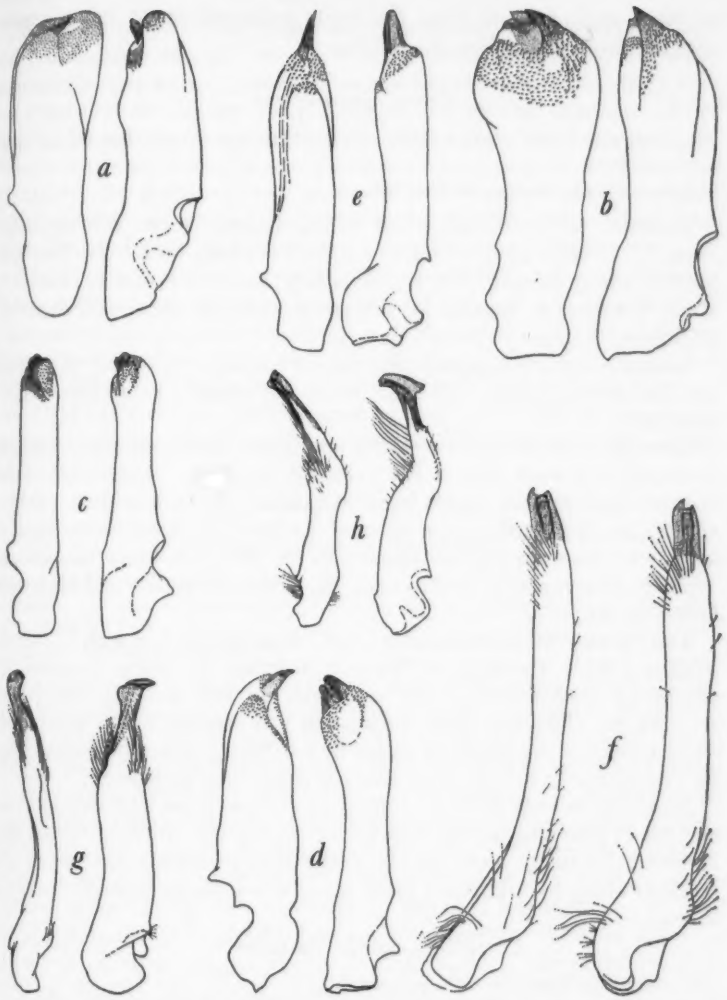


FIGURE 11.—Lateral (left) and caudal (right) aspects of gonopods of *Pachygrapsus* (*a–e* denuded): *a*, *P. crassipes*, Monterey Bay, Calif., carapace length 35.6 mm.; *b*, *P. gracilis*, St. Thomas, Virgin Islands, carapace length 8.7 mm.; *c*, *P. marmoratus*, Gibraltar, carapace length 30.5 mm.; *d*, *P. maurus*, Canary Islands, carapace length 8.5 mm.; *e*, *P. minutus*, Ponape, Caroline Islands, carapace length 8.2 mm.; *f*, *P. planifrons*, Honolulu, Hawaii, carapace length 9.5 mm.; *g*, *P. plicatus*, Hawaii, carapace length 11.7 mm.; *h*, *P. transversus*, Key West, Fla., carapace length 11.1 mm.

whether any of those from the cable anchored in 75 meters were clinging to it far below the surface.

Planes cyaneus Dana

Planes cyaneus Dana, 1852a, p. 250.—Chace, 1951, pp. 65-103, figs. 1b, 2b, e, h, m–o, 3i–n.

?*Varuna atlantica* Melliss, 1875, p. 203.

Material: Off northeast coast of St. Helena; from drifting kelp; Nov. 25, 1960; 1 female.—Sandy Bay; from kelp on beach; Dec. 29, 1962; 1 young female.—Off Rupert's Bay; buoy; 0–2 meters; Feb. 11, 1963; 3 males, 5 females (4 ovigerous).—James Bay; collected by skindiver; February 1964; 1 female.

Measurements: Carapace lengths of males, 14.0–22.7 mm.; of females without eggs, 6.9–26.0 mm.; of ovigerous females, 14.2-16.9 mm.

Remarks: Three or four of the specimens found on the buoy off Rupert's Bay were blue in life (white in alcohol). The others were mottled light to dark brown in alcohol, and three of them had a large, whitish patch extending over much of the anterior part of the carapace, similar to the color pattern illustrated for *Planes minutus* (Linnaeus, 1758) in Murray and Hjort (1912, pl. 6) and Sivertsen and Holthuis (1956, pl. 2).

The "pretty little bright-blue Crab" from the hull of a ship, which Melliss (1875) recorded as *Varuna atlantica* (a name apparently coined by Spence Bate), may represent the first Atlantic record of *P. cyaneus*. The fact that the species was represented in the Loveridge collection by material taken in 4 different years indicates that its occurrence in the South Atlantic is more than transitory.

Distribution: On floating objects in the open sea throughout the eastern Pacific and presumably westward into the Indian Ocean; St. Helena. Probably some or all of the South African records of *P. minutus* cited by Barnard (1950, p. 120) should be referred to this species.

Planes marinus Rathbun

Planes marinus Rathbun, 1914, p. 120, pl. 3.

Pachygrapsus marinus.—Chace, 1951, pp. 65–103, figs, 1c, 2c, f, i, p–r, 3o–t.—Hart, 1959, p. C 31.—Edmondson, 1959, p. 169, fig. 8b.—Dell, 1963, pp. 179, 180, fig. 1.

Material: Off northeast coast of St. Helena; from drifting kelp; Nov. 25, 1960; 1 male, 2 young females.—Off Rupert's Bay; buoy; 0–2 meters; Feb. 11, 1963; 2 ovigerous females.

Measurements: Carapace length of male, 9.1 mm.; of young females, 4.9 and 5.4 mm.; of ovigerous females, 13.4 and 15.1 mm.

Remarks: Dell (1963) noted that this species has natatory fringes on the walking legs, just as do the other two species of *Planes*. The specimens that were available for my earlier study (Chace, 1951) were so worn that this fringe was reduced to stiff bristles at most. All of the St. Helena specimens have well-developed natatory fringes. On the basis of this character and the form of the gonopods, it seems best to return the species to the genus to which it was originally assigned by Rathbun and to minimize the importance of the shape of the carapace and chelipeds, which led me to transfer it to *Pachygrapsus*.

Distribution: At sea, west of Baja California, Mexico; coast of Oregon (from Japanese mine washed ashore); at sea, southwest of Vancouver Island, British Columbia (from netting and barnacles on large Japanese glass float); windward shores of Oahu, Hawaii; Eastern Bay of Plenty, New Zealand (among stalked barnacles on Japanese glass float); St. Helena (first Atlantic record). This species is probably more common on floating objects than the rather sparse records would indicate.

Subfamily Plagusiinae

Plagusia depressa (Fabricius)

Cancer depressus Fabricius, 1775, p. 406.
Plagusia depressa.—Cunningham, 1910, p. 122.—Monod, 1956, p. 455, figs. 614–617.
Plagusia.—Colman, 1946, p. 271.

Material: Off Rupert's Bay; buoy cable; 0–75 meters; Jan. 17, 1958; 1 female.—Same; buoy; 0–2 meters; Feb. 2, 1959; 17 males, 16 females (3 ovigerous), 2 juveniles.—James Bay, West Rocks; Dec. 21, 1959; fragments of cast shell of 1 male.—Off Rupert's Bay; buoy and cable; 0–75 meters; Mar. 18, 1960; 34 males, 20 females (1 ovigerous), 10 juveniles.—Same; Apr. 5, 1962; 1 male.—Same; buoy; 0–2 meters; Feb. 11, 1963; 9 males, 11 females (5 ovigerous), 1 fragmentary specimen.—James Bay; collected by skindiver; February 1964; 4 juveniles.—Same; April 1964; 11 males, 12 females (2 ovigerous).

Measurements: Carapace lengths of males in midline, 9.2–41.5 mm.; of females without eggs, 9.0–23.6 mm.; of ovigerous females, 19.1–33.3 mm.; of juveniles, 5.7–9.2 mm.

Remarks: Most of the St. Helena specimens are immature, with carapace lengths of less than 20 mm. (at about which size the female abdomen attains its full breadth). The largest specimen, except for the cast shell from James Bay, is a male with a carapace length of 35.2 mm. Nearly half (57 of 122) of the specimens from the buoy and cable off Rupert's Bay have carapaces less than 14 mm. long (with triangular female abdomens), but only 12 of these were so small (carapace lengths of less than about 9 mm.) as to be sexually indeterminable.

Comparison of the male gonopods of the species of *Plagusia* in the national collections [*P. chabrus* (Linnaeus, 1758); *P. dentipes* (De Haan, 1835); *P. depressa; P. glabra* Dana, 1852b; *P. immaculata* Lamarck, 1818; *P. speciosa* Dana, 1852a; and *P. tuberculata* Lamarck, 1818] indicated that *P. depressa, P. immaculata,* and *P. tuberculata* are most closely related to each other (although they are probably specifically distinct) than they are to the other four species.

Distribution: West Africa and off-lying islands from Senegal to Angola; western Atlantic from South Carolina to Brazil; Bermudas; St. Helena. Littoral and on ships' hulls and other floating objects.

Family Majidae

Subfamily Acanthonychinae

Acanthonyx sanctaehelenae, new species

FIGURES 12, 13e–h

Material: Off Rupert's Bay; buoy; 0–2 meters; Feb. 2, 1959; 3 males, 1 juvenile [1 male is holotype, USNM 112458].—Same; buoy and cable; 0–75 meters; Mar. 18, 1960; 6 males, 1 female.—Same; Apr. 5, 1962; 1 ovigerous female.—Same; buoy; 0–2 meters; Feb. 11, 1963; 4 males, 1 ovigerous female.

Description: Carapace broadly pear shaped in adults; length of males in midline, not including rostral horns, one-sixth to one-fifth longer than maximum breadth; adult females proportionately broader. Dorsal surface of carapace and legs of large males with very fine but tough pubescence forming tangled mat of long hairs on margins of carapace, chelipeds, and anterior walking legs; less dense covering of shorter hairs on most of dorsal surface of carapace and on posterior legs. Hepatic lobe produced anteriorly, not rectangular. Two low, subequal lobes or teeth on branchial margin. Rostral horns and preorbital, hepatic, and branchial lobes bearing terminal tufts of stout setae. Rostral sinus narrowly V-shaped. Basal article of antennae unarmed, two succeeding articles subcylindrical, reaching as far as end of rostral horns. Chelipeds with merus subtriangular, two lobes near proximal end of outer margin; carpus with blunt outer crest; chela of male swollen, slightly compressed dorsally; fingers gaping throughout in male, only proximally in female. Abdomen with fourth and fifth somites indistinguishably fused in both sexes, third and fourth somites partially so in large males.

Male abdomen and gonopods as figured.

Measurements: Carapace of male holotype, 18.0 mm. long in midline, 20.0 mm. to tip of rostral horn, 15.0 mm. in maximum width. Carapace lengths of male paratypes in midline, 4.7–16+ mm.; of

female without eggs, 4.7 mm.; of ovigerous females, 4.2 and 9.8 mm.; of juvenile, 2.1 mm.

Remarks: Although the St. Helena specimens closely resemble the variable *Acanthonyx petiverii* H. Milne Edwards, 1834, from tropical waters of the western Atlantic and eastern Pacific, and *A. lunulatus*

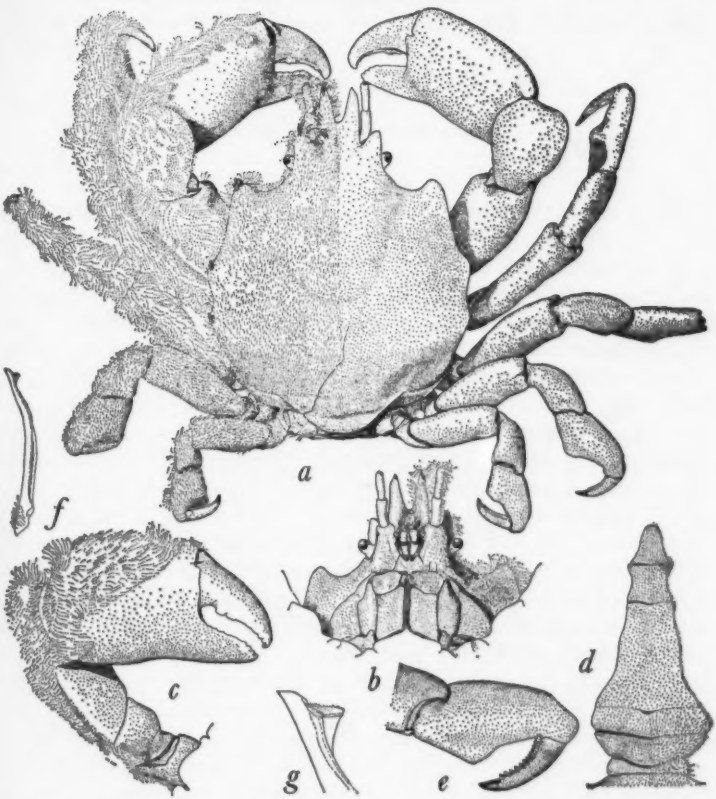


FIGURE 12.—*Acanthonyx sanctaehelenae*, male holotype: *a*, dorsal aspect of crab, right half denuded; *b*, suborbital and buccal regions; *c*, right cheliped; *d*, abdomen; *e*, propodus and dactyl of right posterior leg; *f*, caudal aspect of right gonopod; *g*, tip of same.

(Risso, 1816) from the eastern Atlantic and Mediterranean (fig. 13), I believe that they represent a distinct species. In the general configuration of the carapace, *A. sanctaehelenae* seems nearest to *A. lunulatus*, but apparently it can be distinguished from that species by the broader, more pear-shaped carapace and the V-shaped, rather than broadly U-shaped, sinus between the rostral horns.

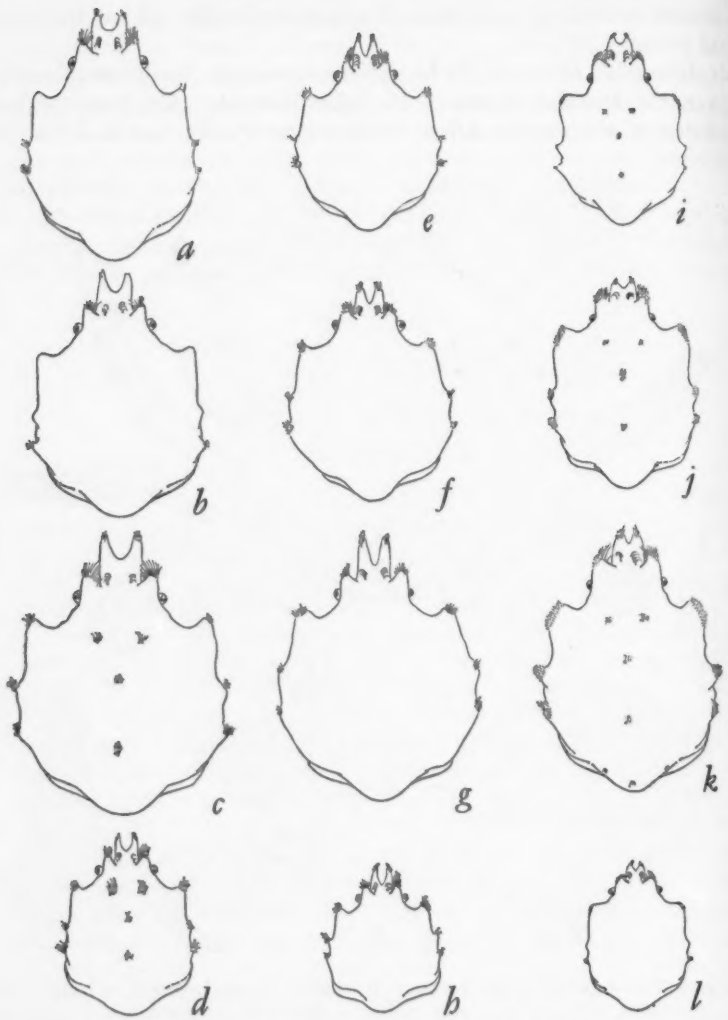


FIGURE 13.—Carapace variation in *Acanthonyx lunulatus* (*a–d*), *A. sanctaehelenae* (*e–h*) and *A. petiverii* (*i–l*): *a*, male, Naples, Italy, carapace length 16.5 mm.; *b*, male, Messina, Italy, carapace length 17.0 mm.; *c*, male, Naples, Italy, carapace length 19.3 mm.; *d*, ovigerous female, Cadaques, Spain, carapace length 12.2 mm.; *e*, male, carapace length 13.0 mm.; *f*, male, carapace length 15.0 mm.; *g*, male, carapace length 18.1 mm.; *h*, ovigerous female, carapace length 9.7 mm.; *i*, male, Martinique, carapace length 13.3 mm.; *j*, male, St. Croix, Virgin Islands, carapace length 15.2 mm.; *k*, male, St. Croix, carapace length 18.5 mm.; *l*, ovigerous female, Martinique, carapace length 10.3 mm.

Only the three largest males, with carapace lengths to the base of the rostral sinus of 14.9 to 18.0 mm., are conspicuously pubescent, and the smallest of these has the matted covering largely confined to the chelipeds. Also, all of the males except the largest (the holotype) have a distinct, though not always completely functional, suture between the third and fourth abdominal somites.

Distribution: Known only from the type locality off Rupert's Bay, St. Helena.

Subfamily Pisinae

Pisa sanctaehelenae, new species

FIGURE 14

Material: Off Rupert's Bay; buoy; 0–2 meters; Feb. 11, 1963; 1 male, 2 ovigerous females [male is holotype, USNM 112459].

Description: Carapace, not including rostral and lateral spines, one-sixth to one-third longer than broad. Regions well marked and uneven. Cardiac region swollen, surrounded by broad, deep furrow accentuated laterally by curved, longitudinal ridge near inner margin of each metabranchial region. Intestinal region with median prominence. Branchial region bearing lateral boss with obscure longitudinal sulcus behind cervical groove and three smaller prominences in oblique row across mesobranchial region, posteriormost forming blunt tooth on posterolateral margin. Surface pubescence sparse, but groups of hooked hairs (shown on left side of fig. 14*a*) on rostral spines, on anterior and posterior portions of each protogastric region, on branchial prominences, and along margin of each branchial region. Rostral spines divergent throughout. Supraocular eave with long anterior spine and distinct tooth at posterior angle. Tooth between supraocular eave and postocular process large, virtually closing dorsal margin of orbit. Strong spine on hepatic region behind postocular process. Four distinct spines on lateral margin of branchial region, first two close together, last largest, nearly as large as hepatic spine. Basal antennal article with long anterior spine visible from above and approaching preocular spine in length. Distinct tooth just posterior to posterolateral angle of basal antennal article. Row of three acute teeth, decreasing in size posteriorly, on each pterygostomian region.

Chelipeds of male about as long as carapace. Merus covered with raised tubercles and four spines, one terminal, in dorsal midline. Carpus with four rows of large tubercles delimiting three broad, longitudinal sulci. Hand with massive tubercle at dorsal articulation with carpus and double row of irregular tubercles or sharp granules forming shallow longitudinal sulcus in dorsal margin; ventral margin with blunt carina on proximal three-fourths; outer surface micro-

scopically roughened but not tuberculate; inner surface swollen and bearing about five pearly tubercles scattered on swollen portion. Fingers meeting in distal half, gaping proximally, with large, rectangular, serrate tooth on basal third of movable finger. Chelipeds of

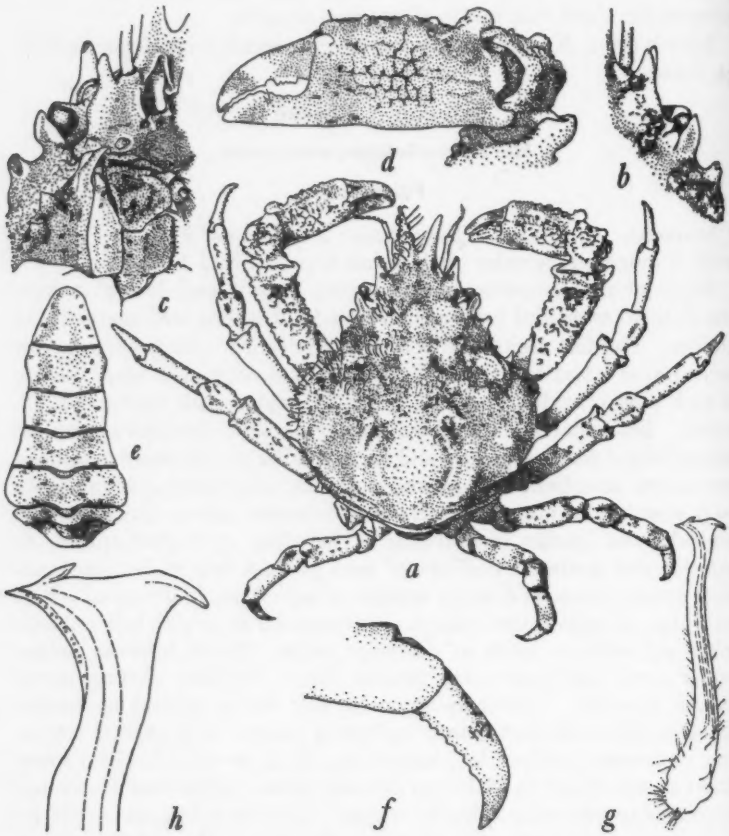


FIGURE 14.—*Pisa sanctaehelenae*, male holotype: *a*, dorsal aspect of crab, right half denuded; *b*, orbit in dorsal view; *c*, suborbital region; *d*, left chela; *e*, abdomen; *f*, dactyl of right posterior leg; *g*, mesiocaudal aspect of right gonopod; *h*, tip of same.

females smaller; merus and carpus strongly spinose; chela smoother, without basal tooth on movable finger. Walking legs decreasing in length posteriorly; merus with rounded dorsal protuberance terminally; carpus with single tubercle near meral articulation, followed by deep longitudinal furrow; propodus of first leg swollen distally in

male only; dactyl with five to seven low tubercles on ventral margin. Male abdomen and gonopods as figured.

Color: In ethyl alcohol, carapace with rusty to orange-red reticulated mottling on grayish background; elevations cream colored. Chelipeds with dark, rusty red patch near distal end of upper surface of merus and reticulations of same color on carpus and on inner and outer surfaces of hand; light orange-red mottling on upper surface of hands and in two bands on fingers. Speckels of red on ambulatory legs and on ventral surfaces of crab.

Measurements: Carapace of male holotype, 11.3 mm. long in midline, 13.2 mm. long to tip of rostral spine, 9.7 mm. wide between branchial margins, 10.7 mm. wide between tips of lateral spines. Carapace of ovigerous female paratypes, 5.8 and 8.2 mm. long in midline, 7.0 and 9.2 mm. long to tips of rostral spines, 4.3 and 6.8 mm. wide between branchial margins, 5.0 and 7.6 mm. wide between tips of lateral spines.

Remarks: *Pisa sanctaehelenae* bears a faint resemblance to *P. carinimana* Miers, 1879, from West Africa and the Canary Islands, but it is readily distinguished by the much stronger preocular and antennal spines, the salient posterolateral angle of the supraocular eave, the larger intermediate supraocular tooth, the more uneven carapace, and the more numerous spines on the branchial margins.[2]

Distribution: Known only from the type locality off Rupert's Bay, St. Helena, where it was represented only in the last of the five collections made from the buoy and cable at that location.

Distribution

The distribution of the 23 species of decapod crustaceans (fig. 15) does not conform exactly with the distribution patterns of St. Helena fishes (Cunningham, 1910, and Cadenat and Marchal, 1963), mollusks (E. A. Smith, 1890), and echinoderms (Mortensen, 1933). Colman (1946, p. 279) concluded from the studies published prior to 1946 that "In each case the principal links are with the West Indies first, and secondly, with the Mediterranean and north-east Atlantic, while there is only a slight connection with South Africa." Cadenat and Marchal (p. 1307) state that "les affinites de cette faune sont tres nettement plus antillaises que ouest-africaines." On the contrary, the decapods seem to be more closely allied to the West African than to the East American faunas. Excluding the six decapods that are found in

[2] *Pisa sanctaehelenae* seems to differ from the closely related *P. calva* Forest and Guinot, 1966 (p. 99, figs. 10, 11a–f, 13), in its divergent rostral spines, more salient posterolateral angle of the supraocular eave, and more angularly sinuous shaft of the male gonopod.

both the western and eastern Atlantic, only three species are common to St. Helena and eastern America, whereas seven West African species are represented at St. Helena.

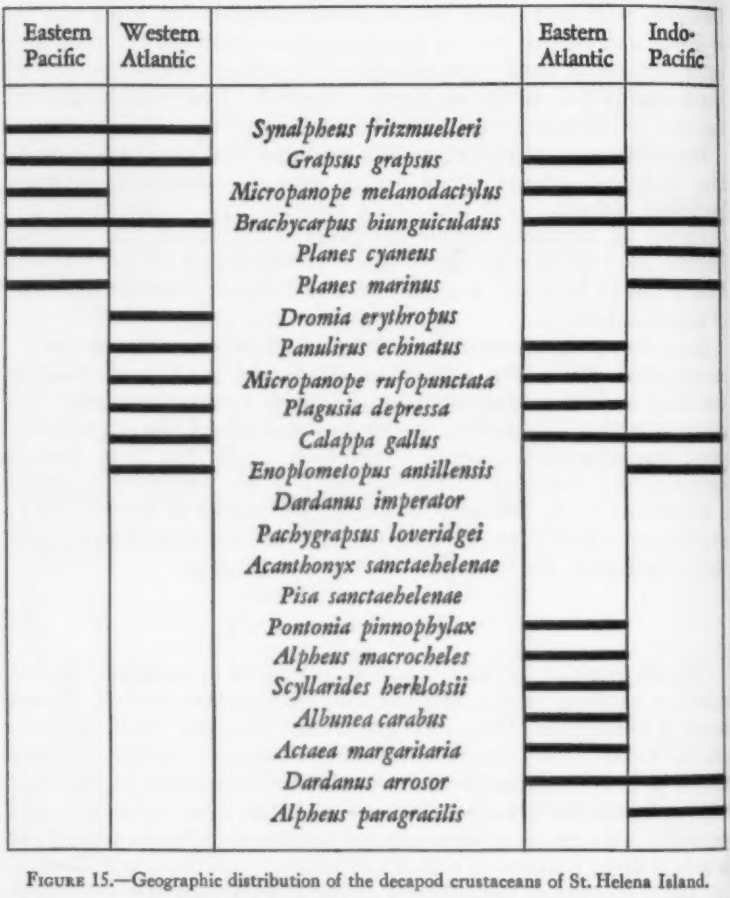


FIGURE 15.—Geographic distribution of the decapod crustaceans of St. Helena Island.

Only one of the decapods, the oceanic crab *Planes cyaneus*, probably reached St. Helena from South Africa. This ratio corresponds with that in the St. Helena echinoderms, of which only *Asterina exigua* now occurs in South Africa. Mortensen believed that this sea star was transported on floating kelp, which is regularly carried from South

Africa to St. Helena in the trade-wind drift; this explanation almost certainly applies to *Planes*, which is a habitual passenger on floating weed. *Calappa gallus*, which occasionally occurs on the east coast of South Africa, probably never reaches the Cape of Good Hope, and there is little likelihood that it migrated directly from there to St. Helena in the recent past. The evidence of a link between the faunas of St. Helena and South Africa is even more obscure in the mollusks, of which only 6 of 182 St. Helena species were known from South Africa, but Cunningham reported a closer relationship in the fishes, of which no less than 12 of 33 St. Helena species were reported from South Africa.

One of the more surprising disclosures of the study of the Loveridge collections is the number of Pacific species represented. The proportion of decapods common to St. Helena and to the Indo-Pacific (30 percent) and eastern Pacific (26 percent) is noticeably greater than it is in the fishes (24 and 18 percent), mollusks (8 and 5 percent), and echinoderms (15 and 8 percent). Also, at least four of the decapods that have been reported from the Pacific (*Alpheus paragracilis*, *Enoplometopus antillensis*, *Micropanope melanodactylus*, and *Planes marinus*) seem to have discontinuous distributions. (The probable occurrence of *Planes cyaneus* off South Africa eliminates that crab from this group.) A possible explanation for such interrupted distributional patterns (aside from insufficient collecting) is that some of the species have been transported on the hulls of ships. For those species that could withstand a few days' exposure to cool temperatures, there was ample opportunity for introduction to St. Helena by this method when the island was a regular port of call for vessels sailing around Cape Horn or the Cape of Good Hope before the construction of the Suez and Panama Canals.

Finally, the four possibly edemic decapods thus far described from St. Helena (*Dardanus imperator*, *Pachygrapsus loveridgei*, *Acanthonyx sanctaehelenae*, and *Pisa sanctaehelenae*) are proportionately fewer (17 percent) than are the fishes (29 percent), mollusks (52 percent), and echinoderms (50 percent) that are confined to St. Helena (and Ascension Island). Further collecting, or even the study of existing collections, may reveal additional undescribed species, and it is not unlikely that specimens now assigned to some of the more widely ranging species, such as *Pontonia pinnophylax*, *Alpheus macrocheles*, *Panulirus echinatus*, *Enoplometopus antillensis*, *Dardanus arrosor*, *Albunea carabus*, and *Dromia erythropus*, will eventually prove to be specifically or subspecifically distinct.

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By J. A. F. GARRICK

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REVISION OF SHARKS OF GENUS *ISURUS* WITH DESCRIPTION OF A NEW SPECIES (GALEOIDEA, LAMNIDAE)[1]

By J. A. F. Garrick[2]

The genus *Isurus* comprises the mako or mackerel sharks, worldwide in distribution throughout tropical and temperate seas. Opinion from recent accounts as to the number of extant species in the genus ranges from two or three (Bigelow and Schroeder, 1948) to four (Smith, 1957, 1958). In the study reported below, considerably more material has been examined than was available to other workers, and it is concluded that the 12 nominal species of *Isurus* represent only 1 worldwide species. However, in addition, there is another very distinctive species which does not appear to have been described.[3] Presentation of the evidence for these findings and description of the new species are the purposes of this paper.

This study is based on 35 specimens from which fairly complete measurements of external dimensions have been taken. For another 8 specimens only incomplete data are available. In addition some

[1] This study has been supported by grants from the University of New Zealand, by Atomic Energy Commission contract AT(30-1)2409, and by National Science Foundation Grant GB-245.

[2] Department of Zoology, Victoria University of Wellington, New Zealand.

[3] At the time this paper was in galley, Guitart Manday (July 1966) described, under the name *Isurus paucus*, a mako shark that is clearly the same as the species which I describe as new in this account. For further details, see Addendum.

proportions have been extracted from the original descriptions or from the illustrations of the types of the nominal species *I. africanus*, *I. bideni*, *I. cepedii*, *I. dekayi*, *I. glaucus*, *I. gomphodon*, *I. guentheri*, *I. huidobrii*, and *I. tigris*. Comparable data could not be obtained from the descriptions of *I. mako*, *I. oxyrinchus*, and *I. spallanzani* for a variety of reasons: either no measurements or proportions were given, or no indication of the size of the specimen concerned was included, or illustrations were poor or lacking. The reliability of the data from some of the original descriptions is discussed on page 666 and elsewhere in this paper.

Seventeen of the specimens for which there are full data have been examined and measured by me. These include: one from the western North Atlantic; one from the eastern North Atlantic; two from Japan; three from California; seven from New Zealand; one from South Africa; and two from the Indian or Pacific Oceans (exact locality uncertain). Measurements were made in the manner outlined by Bigelow and Schroeder (1948, p. 61).

Data from 13 specimens taken in the central Pacific during 1952 through 1955 by the program of Pacific Oceanic Fishery Investigations of the U.S. Fish and Wildlife Service were supplied by Dr. Donald W. Strasburg. These were reported earlier in summarized form by Strasburg (1958). J. Moreland provided measurements of a New Zealand specimen, and S. Gruber supplied measurements of one from New York.

Information was obtained from recently published accounts of four specimens from Madagascar (Fourmanoir, 1961), three specimens from South Africa (Smith, 1953, 1957, 1958), and two specimens from the western North Atlantic (Bigelow and Schroeder, 1948).

The material included 31 males, 11 females, and 6 specimens for which the sex was not recorded. No sexual dimorphism was observed in proportions. In total length the specimens ranged from late embryos 605 mm. long to an adult of 3,200 mm., the latter a cast of a New Zealand female in the Auckland Museum.

Many of the specimens were discarded after they had been measured, but some were preserved whole. The latter are listed under Study Material in the accounts of the two species given here.

My thanks are due to the many colleagues who have assisted in this study by providing specimens and data. To those at the institutions mentioned variously in this account I would add Dr. T. Abe (Tokaiku Suisan Kenkyujo, Tokyo, Japan) for his considerable contribution in supplying three specimens of the new species of *Isurus* described here; F. Begley of Awanui, New Zealand, for assistance in obtaining specimens of New Zealand makos; Dr. L. R. Richardson (formerly of Victoria University of Wellington, New Zealand) for his

sustained interest and discussions on the problem; and several colleagues who have read and offered valuable suggestions on the manuscript. The illustrations of the teeth of two makos (figs. 8, 9) are by Peter A. McCrery.

Although the nominal species treated here have been placed in several genera by some authors, opinion has stabilized in more recent years to include them all in *Isurus* Rafinesque. It will be apparent from the treatment of these nominal species in this account that recognition of *Isurus* alone is the only possible course.

The nominal species of *Isurus* listed in the order in which they were proposed[4] are:

species	*locality*	*total length(s) of type(s)*
Isurus oxyrinchus[5] Rafinesque, 1810a	Sicily	—
Isurus spallanzani Rafinesque, 1810b	Sicily	—
Squalus (*Lamna*) *cepedii* Lesson, 1830	Tropical Atlantic	1830 mm.
Oxyrhina gomphodon Müller and Henle, 1841	oceanic	ca. 1700 mm.
Oxyrhina glauca Müller and Henle, 1841	Japan	1020 mm., 750 mm., 660 mm.
Isuropsis dekayi Gill, 1862b	New York	3100 mm.
Carcharias tigris Atwood, 1869	Massachusetts	2690 mm.
Lamna guentheri Murray, 1884	Kurrachee, India	2580 mm.
Lamna huidobrii Philippi, 1887	Chile	2900 mm.
Isurus mako Whitley, 1929	New Zealand	—
Isurus bideni Phillipps, 1932	South Africa	1195 mm.
Isurus africanus Smith, 1957	South Africa	2540 mm.

The characters separating *Isurus* from the other two genera, *Lamna* and *Carcharodon*, in the family Lamnidae are: upper teeth smooth edged, lacking lateral basal denticles; first dorsal origin definitely behind a vertical through posterior (inner) corner of pectoral fin; and no secondary lateral keel along anterior part of caudal fin. In *Lamna* the teeth are smooth edged but have lateral basal denticles, at least in subadults and adults. In *Carcharodon* the teeth are serrated. Both *Lamna* and *Carcharodon* have the first dorsal origin anterior to a vertical through the posterior corner of the pectoral. *Lamna*, but

[4] See Addendum.

[5] Tortonese (1956, p. 106, ftn. 1) claims that, under Article 19 of "The Code of Zoological Nomenclature," this spelling should be emended to "*oxyrhynchus*." However, if we consider that Rafinesque used the spelling "*oxyrinchus*" twice in his 1810a account (once on page 12, and again on plate 13) and repeated it in his 1810b account (p. 45), and nowhere used the spelling "*oxyrhynchus*," we have no reason to believe that "*oxyrinchus*" was an inadvertent error. Consequently, according to Article 32(b), the spelling "*oxyrinchus*" must be treated as the correct original spelling and is not to be emended.

not *Carcharodon*, has a secondary lateral keel on the anterior part of the caudal fin.

Comparing the original (and some later) accounts of the nominal species of *Isurus* with the diagnostic criteria mentioned above reveals discrepancies in a few cases. For example, the original illustration of *I. gomphodon* in Müller and Henle (1841, pl. 28) shows the first dorsal origin above the pectoral axil—a character of *Lamna*. However, the teeth, as illustrated, are clearly those of an *Isurus*, and likewise there is no secondary caudal keel. Müller and Henle's illustrations are, for the most part, accurate representations, so one is led to the assumption that the illustration of *I. gomphodon* was made from a distorted specimen. The type and only specimen, a mounted skin, was deposited in the Berlin Museum but unfortunately cannot be found. Compared with other makos, the illustration of *I. gomphodon* shows a considerably shorter body sector as measured between pectoral axil and pelvic origin (see table 1, E). Also the first dorsal fin is higher than usual (fig. 3), and the pectoral is longer (figs. 1–2)—though not as long as that of the new species described below. On this evidence there is reason to believe that the skin of the type of *I. gomphodon* underwent shrinkage along its midsector when it was being mounted. Consequently, the proportions of *I. gomphodon* must be used with caution.

Isurus spallanzani, first illustrated in Bonaparte (1839, pl. 136, fig. 1) from an Italian specimen, is also shown with the first dorsal origin over the pectoral axil, but again it is clear that the specimen was an *Isurus*. Conversely, Bonaparte's illustration (1835, pl. 134, fig. 2) in the same account, of *Lamna cornubica*, has the first dorsal origin slightly behind the pectoral posterior corner—a character of *Isurus*. It must be presumed that Bonaparte's illustrations are inaccurate in these features for subsequent accounts of *Isurus* and *Lamna* from Italian waters (e.g., Tortonese, 1956) do not agree with Bonaparte but instead show the "normal" positioning of the first dorsal fin relative to the pectoral fin.

The above-mentioned discrepancies make understandable the confusion which has arisen between *Isurus* and *Lamna*. The persistence of such confusion is exemplified by Waite's (1921, p. 21, fig. 27) illustration of an Australasian specimen of *Lamna nasus* as *Isurus glaucus*. Waite's illustration was later redrawn by Barnard (1925, pl. 1, fig. 6) who used it for *I. glaucus* in his account of South African fishes. Whitley (1940, p. 123, fig. 130) also used Waite's illustration but identified the shark as *I. mako*.

Isurus guentheri stands noticeably apart from the other 11 nominal species in having many more teeth. Murray's (1884, pp. 348–351) account of the type, the only information available for the species,

credits it with having $\frac{22}{28}$ teeth in each side of the jaws. In all other makos so far reported there is a range of $\frac{10 \text{ to } 14}{10 \text{ to } 15}$ teeth in each side of the jaws. Murray's account stresses the fact that his species has many teeth, thereby lessening the likelihood that his count is in error. However, because no other mako has been reported with a comparable number of teeth, and in view of the fact that Murray's count is twice that for other makos, I believe that Murray's count should be regarded as in error. I, therefore, follow Smith (1957, p. 92) and some earlier workers in treating Murray's count of $\frac{22}{28}$ as being a total count rather than the count of the teeth in each side of the jaws.

Examination of my data on the proportional dimensions of the makos used in this study shows that only in pectoral fin length is there any clear-cut evidence of the existence of more than one species. In figure 1, where the length of the pectoral fin relative to prepectoral length is expressed against total length, five specimens stand well apart from the remainder in having considerably longer pectorals. These

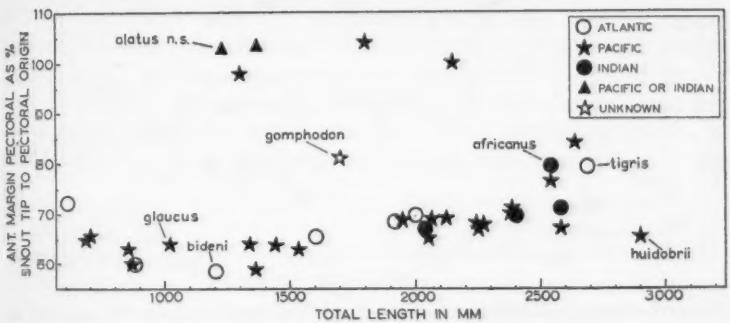

FIGURE 1.—*Isurus*, separable into long-finned and short-finned species by the length of the pectoral fin relative to prepectoral length (identified specimens are types of the nominal species).

specimens include three from the central Pacific (data from Dr. Donald W. Strasburg) and two specimens supplied by Dr. Tokiharu Abe. The latter two were taken by Japanese long-line vessels in either the Pacific or Indian Oceans. The only specimen that does not obviously fit within the two groupings in figure 1 is the type of *I. gomphodon* which is more or less intermediate though favoring the short-finned group. However, as already discussed, the dimensions of *I. gomphodon* are suspect, and its fins are probably relatively shorter than its illustrated total length suggests. On this basis *I. gomphodon* can be aligned with the short-finned group.

Figure 2, where pectoral fin length as a percentage of total length is expressed against total length, shows the same two groupings as in figure 1. The long-finned group includes the five specimens which were distinctive in figure 1 and also two more which were omitted in figure 1 for lack of definite data on head length. These two are a specimen from off Madagascar, reported in Fourmanoir (1961, pp. 78-79), and the type of *I. cepedii*. Fourmanoir's records indicate that he had short-finned makos as well as the long-finned specimen, and he notes that there were differences in form and weight "sans pouvoir définir avec certitude une deuxième espèce." One apparent error in the dimensions which Fourmanoir gives for his long-finned specimen (2,180 mm. total length) is the length from snout tip to pectoral origin (800 mm.). This is 36.7 percent of the total length, a percentage far too great for any mako. Presumably the 800 mm. length was meant to be for snout tip to first dorsal origin, as this dimension is omitted for the long-finned specimen but supplied for the others.

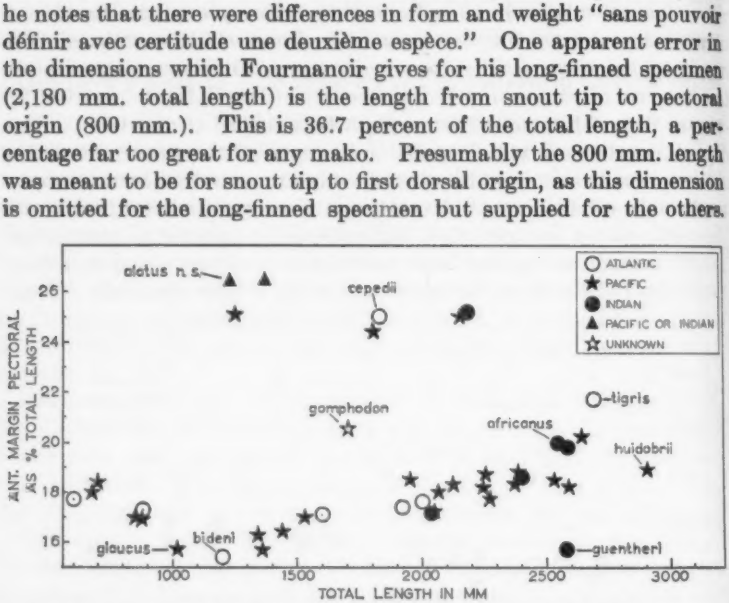

FIGURE 2.—*Isurus*, separable into long-finned and short-finned species by the length of the pectoral fin relative to total length (identified specimens are types of the nominal species).

If the type of *I. cepedii* rightly belongs with the long-finned group as figure 2 would indicate, then the long-finned species must take the name *I. cepedii*. However, for the reasons given below, I do not follow this course but instead describe the long-finned species as new (p. 677).

Isurus cepedii was described by Lesson (1830, p. 93) from a specimen 6 feet long taken in the tropical Atlantic. No illustration was given, but the description, particularly of the teeth and snout, is clearly that of an *Isurus*. The pectoral length is given as "près d'un pied et demi"; attention is drawn to the fact that this is an approximate length. The color on the underside of the snout is described as "Un blanc nacré," whereas in the three long-finned

makos which I have seen, the underside of the snout and around the lips is at least partly dusky. Lesson states that the caudal fin is deeply forked, the dorsal lobe with a "haut de 15 pouces," the ventral lobe with a "haut à peine de 8 Pouces." I assume that by "haut" Lesson meant the length of each lobe from its origin to tip. If this is so, Lesson's stated length of 15 inches for the dorsal lobe on a 6-foot long specimen is in agreement with other makos. But his stated length of 8 inches for the ventral lobe would be far too short. In all my material the length of dorsal lobe divided by the length of the ventral lobe ranges from 1.19 to 1.54, whereas in *I. cepedii* it is 1.88. The difference is sufficient to throw considerable doubt on the validity of Lesson's measurements, and in consequence of this, plus the discrepancy in snout color and the lack of type material to provide confirmation, I cannot regard the evidence as warranting the recognition of *I. cepedii* as a long-finned mako.

Figures 3, 4, 5, and table 1 were constructed from data on short-finned makos only. In figures 3–5 individual specimens are plotted, while in table 1 the data is summarized for three size groups, plus the types wherever possible. The various proportions represented in the figures and table are those which have been used by recent authors, particularly Bigelow and Schroeder (1948), and Smith (1957, 1958), as diagnostic criteria for the several species of *Isurus* they recognize. In summary, these diagnostic criteria are based on: the proportions of the first dorsal fin (height relative to base), its position and its shape; the height of the first dorsal fin relative to the

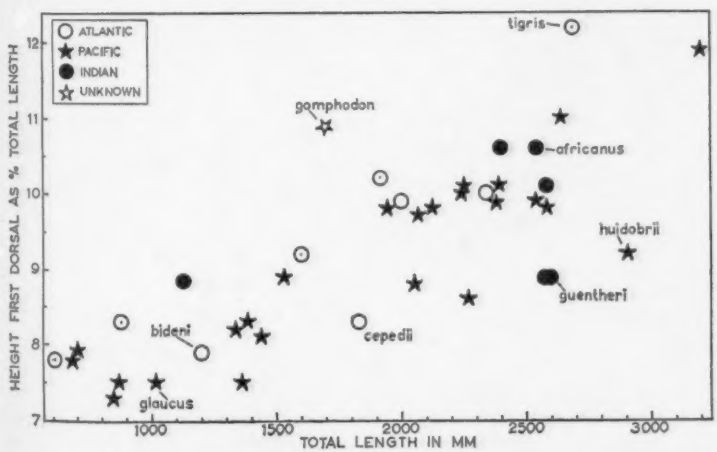

FIGURE 3.—*Isurus*, short-finned only, showing growth change in height of first dorsal fin relative to total length (identified specimens are types of nominal species).

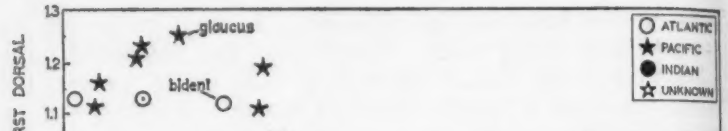

FIGURE 4.—*Isurus*, short-finned only, showing change with growth of the relative proportions of the first dorsal fin (identified specimens are types of nominal species).

head length; the head length relative to the distance between the pectoral fin axil and the pelvic fin origin; and the distance between the origins of the pectoral fin and first dorsal fin relative to parts of the head length. Figures 3–5 and table 1 do not support Bigelow and Schroeder's criteria for distinguishing Atlantic and Pacific species of *Isurus*, nor Smith's recognition of two or more species within each of the major oceans. Instead the figures and table provide fairly strong evidence that short-finned makos undergo considerable change with growth in some proportions and are variable in others. The amount of variation is large, but much of it may be due to differences

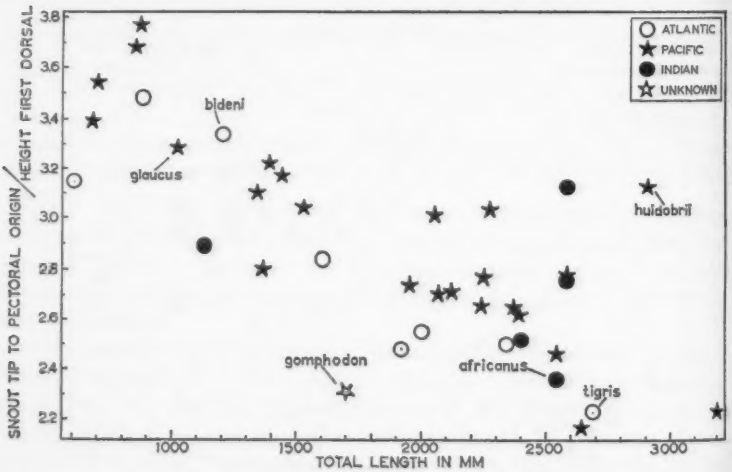

FIGURE 5.—*Isurus*, short-finned only, showing growth change in the height of the first dorsal fin relative to prepectoral length (identified specimens are types of nominal species).

in methods of measurement rather than to real differences. To what extent this is true cannot be assessed, for only a few of the many accounts which were abstracted to provide data used in the figures and table give any indication of the measuring methods used. Examples of the growth change and variation shown in the figures and table are as follows. The height of the first dorsal fin undergoes a very significant proportional increase with growth (fig. 3) while its base remains a constant proportion (table 1, A). The ensuing relationship of first dorsal height to base[6] with growth is as in figure 4. Prepectoral length shows no obvious change with growth but is rather variable (table 1, B). Comparing prepectoral length with first dorsal height relative to total length gives the plot shown in figure 5. The distance between the pectoral axil and the pelvic fin origin increases proportionately with growth (table 1, E). The distance between the pectoral fin origin and the first dorsal fin origin does not show growth change but is variable at all sizes (table 1, D); the relationship of this distance to the length from the posterior of the eye to the first gill opening is summarized in table 1, H. Various other proportions which have been used by Bigelow and Schroeder (1948) and Smith (1957) are given in table 1, C, F, G, I, and J; these similarly show growth change and variation but need not be discussed further here.

One other character which has been thought to be of prime diagnostic significance is the shape of the first dorsal fin apex. A broadly rounded apex has been regarded as a character of *I. glaucus*, while a more angular or acutely angled apex has been ascribed to *I. oxyrinchus* and *I. tigris*. This character, like that of first dorsal fin height, is profoundly altered with growth. All juvenile makos have broadly rounded first dorsals, and in all the apex becomes increasingly angular with growth. The same phenomenon occurs in nearly all sharks. Figure 6 illustrates a range of fin shapes, with growth, in four New Zealand makos, plus an Atlantic embryo which has the "*I. glaucus*," i.e., Pacific, type of fin. According to contemporary accounts, the New Zealand makos illustrated here would be variously identified as *I. glaucus*, *I. oxyrinchus*, and *I. tigris*.

Comparing the diagnostic criteria used by Bigelow and Schroeder (1948) and by Smith (1957, 1958) with my data shows that the species

[6] Krumholz' report (Copeia, 1957, no. 4, p. 302) of a large mako, 3,023 mm. long, from the Bahamas, gives its first dorsal height and base as 8.2 percent and 10.1 percent of total length respectively—dimensions that are quite unlike those of any large mako I have seen. Kodachromes of the Bahama mako, kindly loaned by Dr. Krumholz, clearly show that the quoted dorsal fin dimensions are in error—perhaps transposed—because the first dorsal height is noticeably greater than the base, rather than the reverse as stated in Krumholz' account.

recognized by these authors are largely dependent on specimen size. Thus only juveniles clearly fit the criteria of *I. glaucus*, while middle-sized specimens show more affinity with *I. oxyrinchus*, and large specimens usually agree with *I. tigris*. In the case of *I. glaucus* and *I. tigris* these size characterizations follow from the sizes of the types; the types of *I. glaucus* were juveniles, the largest being 1,020 mm. long (selected by Boeseman (1947, p. 217) as lectotype), and the type of *I. tigris* was a large adult, 2,690 mm. long. *Isurus oxyrinchus* has been interpreted in recent years mostly from the excellent account and illustrations of a specimen 1,640 mm. long in Bigelow and Schroeder (1948, p. 125, fig. 18). Application of Bigelow and Schroeder's and of Smith's criteria for the species does not produce clear-cut results when a series of specimens is examined. This of course would be expected in view of the evidence given here on the size-dependency of the criteria and on the variation which occurs. Thus Cadenat (1962, p. 309) reports that four West African specimens which he has examined show more affinity with *I. tigris* as recognized by Smith, but in some characters, differing from specimen to specimen, there is agreement with *I. oxyrinchus*. I have found similar overlap in New Zealand specimens which, if small, could be variously identified as *I. glaucus* or *I. oxyrinchus* depending on the character used, or if large could be *I. oxyrinchus* or *I. tigris*. Dr. F. Talbot informs me (personal communication) that a series of makos caught off Capetown offered the same problems.

Examination of the features which were thought distinctive for the nominal species of makos when first described does not provide any other evidence for recognizing more than one species of short-finned mako. Rafinesque (1810b, p. 60) distinguished his Mediterranean *I. spallanzani* from the Mediterranean *I. oxyrinchus* on the grounds that *I. spallanzani* lacked a lateral line. However, all makos have lateral lines. Lesson (1830, p. 93) did not diagnose his Atlantic *I. cepedii* and made no comparison with other makos. Müller and Henle (1841, p. 69) differentiated the Pacific *I. glaucus* from *I. gomphodon* (locality unknown) on the position and shape of the first dorsal fin—features already treated here. Gill (1862b, p. 409) named the Atlantic *I. dekayi* on De Kay's (1842, p. 352) account of *Lamna punctata*, but in neither account is there any discussion of the diagnostic characters. Atwood (1869, p. 268) compared his Atlantic *I. tigris* only with *Carcharias atwoodi* Storer which is now known to be a synonym of *Carcharodon carcharias*. Murray (1884, p. 349) differentiated his Indian Ocean *I. guentheri* from *I. glauca* and *I. spallanzani* (and from *Lamna cornubica*) on the basis of its greater number of teeth, the position and shape of the fins, the length of the caudal keel, and the presence of a prominent lateral line. The question of

the number of teeth has been discussed on page 666; I do not find any of the other so-called differences to be valid. Philippi (1887, p. 548) distinguished his eastern Pacific *I. huidobrii* from *Lamna cornubica* by its teeth. He implied the need for comparison with *I. spallanzani*, but otherwise there is no discussion of diagnostic features. Whitley (1929, p. 101) named the New Zealand *I. mako* on the characters given in Phillipps' (1926, p. 530) account of *I. glaucus*. Phillipps compared his material with *I. glaucus* of Müller and Henle and with that of Waite (1921, p. 21) which was, in fact, a specimen of *Lamna nasus*. The only character which Phillipps thought distinctive was the relative lengths of the dorsal and ventral lobes of the caudal fin. His figure for these, 1.27, comes well within the values given here (table 1, J) for other short-finned makos. Phillipps (1932, p. 227) named the South African *I. bideni* using the description in Whitley (1931, p. 140). He distinguished *I. bideni* from *I. mako* and *I. glaucus* on the height of the first dorsal fin, the shape and dimensions of the caudal fin, and the position of the anal fin, viz, "Anal base wholly behind second dorsal." Of these three, only the last-mentioned character is unusual. I have found no mako with the anal fin as far back, relative to the second dorsal fin, as Phillipps shows in his figure of *I. bideni*, and presume that the figure is inaccurate in this feature. Smith (1957, p. 96) provisionally proposed the subspecies *I. tigris africanus* for a 2,540 mm. specimen from South Africa on the grounds that its first dorsal fin was less acute apically and slightly lower than Atlantic and Australasian specimens of *I. tigris*. In a later account Smith (1958, p. 134) recognized his subspecies as *I. africanus* but without further clarification of its distinctive features. As can be seen from figure 3 in the present account, *I. africanus* does not merit specific status in regard to its first dorsal fin height.

Cadenat (1962, p. 305) has suggested the probability that a further and as yet unnamed species of *Isurus* is present in the tropical Atlantic. This *Isurus*, which Cadenat knew only from the head of a specimen taken by a Japanese long-liner south of Cape Verdes Islands, differs from other makos in the number and arrangement of the upper teeth. Its dental formula is $\frac{8\text{–}2\text{–}2\text{–}8}{12\text{–}12}$. In the upper jaw there are two large teeth close together on each side of the symphysis, followed by a distinct space separating them from the smaller lateral teeth. In all other makos, including the new species described on p. 677, there are similarly two large teeth on each side of the symphysis, but these are closely followed by a noticeably smaller tooth which in turn is separated by a space from the larger lateral teeth. Also most makos have more lateral teeth than Cadenat's specimen. The first upper tooth of Cadenat's specimen has an incomplete cutting edge along the lateral

margin of its cusp—it agrees therefore with short-finned makos in this respect and not with the long-finned species described as new here. Cadenat regarded as improbable the likelihood that his mako is abnormal, on the grounds that the abnormality would not be bilaterally symmetrical. Evaluation of the status of the specimen must await further material.

Cadenat also pointed out that of the *Isurus* material that he has examined, the jaws of 12 specimens from Madeira, Senegal, and the Ivory Coast in the collection of l'Institut Français d'Afrique Noire at Gorée, Senegal, are very consistent in having a dental formula of $\frac{10\text{–}3\text{–}3\text{–}10}{13\text{–}13}$. Jaws which Cadenat has seen from other localities show more or less variation, and Pacific specimens generally tend to have fewer lower teeth. The tabulation below gives frequency distributions for the number of lower teeth in *Isurus* specimens from the Pacific, Atlantic-Mediterranean, and Indian Oceans, using Cadenat's data plus my own. This tabulation tends to confirm Cadenat's view that Pacific specimens have fewer lower teeth, though a more adequate sample of Pacific material is needed to substantiate the view.

Counts of teeth in one-half of the lower jaw of *Isurus oxyrinchus* are as follows:

number of teeth	*Pacific*	*Atlantic-Mediterranean*	*Indian Ocean*	*total*
10			1	1
11	2	2		4
12	7	9		16
13	5	27	4	36
14		5		5
15	1	1		2
16	1			1

On the basis of the above discussion, I regard as conspecific all short-finned makos presently reported, viz, the 12 nominal species listed on page 665; they take the name *Isurus oxyrinchus* Rafinesque, 1810.

Isurus Rafinesque, 1810

Isurus Rafinesque, 1810a, p. 11. [Type species *Isurus oxyrinchus* Rafinesque, 1810a, by monotypy.]

For generic synonymy, see Bigelow and Schroeder (1948, p. 123).

Isurus oxyrinchus Rafinesque, 1810

Short-finned Mako

Isurus oxyrinchus Rafinesque, 1810a, p. 12, pl. 13. [Sicily.]
Isurus spallanzani Rafinesque, 1810b, p. 45. [Sicily.]
Squalus (*Lamna*) *cepedii* Lesson, 1830, p. 93. [Tropical Atlantic.]
Oxyrhina gomphodon Müller and Henle, 1841, p. 68, pl. 28. [Oceanic.]

Oxyrhina glauca Müller and Henle, 1841, p. 69, pl. 29. [Japan.]
Isuropsis dekayi Gill, 1862b, p. 409. [New York.]
Carcharias tigris Atwood, 1869, p. 268. [Massachusetts.]
Lamna guentheri Murray, 1884, p. 348. [Kurrachee, India.]
Lamna huidobrii Philippi, 1887, p. 548, pl. 3. [Chile.]
Isurus mako Whitley, 1929, p. 101. [New Zealand.]
Isurus bideni Phillipps, 1932, p. 227, fig. 2. [South Africa.]
Isurus africanus Smith, 1957, p. 96. [South Africa.]

STUDY MATERIAL.—Preserved: Mus. Comp. Zool. (Harvard) no. 37994, male embryo, 605 mm., Bahamas, Cat Cay, 1952, J. M. Olin; Univ. Zool. Mus. (Copenhagen) no. PO557, female embryo, 605 mm., Japan, Nagasaki, 1911, D. S. Jordan; Mus. Comp. Zool. (Harvard) no. 1039, male, 682 mm., Japan, Jan. 17, 1903, A. Owston; Univ. Michigan Mus. Zool. no. 94726, male, 705 mm., California, San Pedro market, 1931, L. A. Walford; Scripps Inst. Oceanogr. no. 62–386, male, 745 mm., Mexico, Baja California, between Guadalupe Island and mainland, June 1962, S. Kato; Scripps Inst. Oceanogr. no. 50–240, male, about 775 mm., California, San Diego, about 14 mi. W. of Point La Jolla, Nov. 17, 1950, B. Evernham; Univ. Michigan Mus. Zool. no. 177116, female, 842 mm., Japan, Suruga Bay, near Shimizu, July 1, 1929, C. L. Hubbs et al; Mus. Comp. Zool. (Harvard) no. 35071, male, 847 mm., Japan, Tokyo market, January 1939; Dominion Mus. (New Zealand) no. 2945, female, 871 mm., New Zealand, Bay of Islands, March 1960, J. Moreland; Scripps Inst. Oceanogr. no. 59–372, male, 1,340 mm., California, La Jolla, Nov. 5, 1959; Univ. California, Los Angeles no. 60–202, female, 1,365 mm., California, Palos Verdes, June 17, 1960; Dominion Mus. (New Zealand) no. 2178, male, 1,390 mm., New Zealand, Bay of Islands, March 1957; Dominion Mus. (New Zealand) no. 3014, female, 1,438 mm., New Zealand, North Cape, Feb. 28, 1955, P. Sheehan; U.S. Nat. Mus. no. 197706, female, 2,000 mm., eastern North Atlantic, west of the Azores, May 5, 1963, B. B. Collette; Dominion Mus. (New Zealand) no. 1279, male, 2,240 mm., New Zealand, Paraparaumu, Apr. 22, 1958, A. S. Henderson.

Type material of two of the nominal species recognized here as synonyms of *I. oxyrinchus* was examined. This material included the jaws of the 2,540 mm. male holotype of *I. africanus* at Rhodes University (Grahamstown, South Africa) and the lectotype and two paratypes of *I. glaucus* at the Rijksmuseum van Natuurlijke Historie (Leiden). The types of *I. glaucus* are mounted skins, from Japan (not Java as stated by Müller and Henle, 1841), collected by D. W. Burger, and are as follows: no. 2529, lectotype, male, about 1,020 mm.; nos. 2533 and 2587, paratypes, males, about 750 mm. and 660 mm., respectively.

Jaws of additional specimens were examined from the collections of the above-mentioned institutions and from others including the South African Museum (Capetown), the Institut Français d'Afrique Noire (Gorée, Senegal), the American Museum of Natural History (New York), and the California Academy of Sciences (San Francisco).

Discarded after measurement and examination: Two males, 1,050 mm. and 2,535 mm., and one female, 2,642 mm. from New Zealand; one female, 1,920 mm., from off Cape Peninsula, South Africa.

DIAGNOSIS.—An *Isurus* with short to moderately long pectoral fins, always shorter than length of head (pectoral fin length usually less than 70 percent of head length but up to 84 percent in very large specimens); with underside of snout and around mouth white in color; and with first tooth on each side of symphysis in both jaws having an incomplete cutting edge on its lateral margin (cutting edge extending only part way from tip of cusp toward base) except in very large specimens, 2,500 mm. long or more, where the cutting edge approaches or reaches the base.

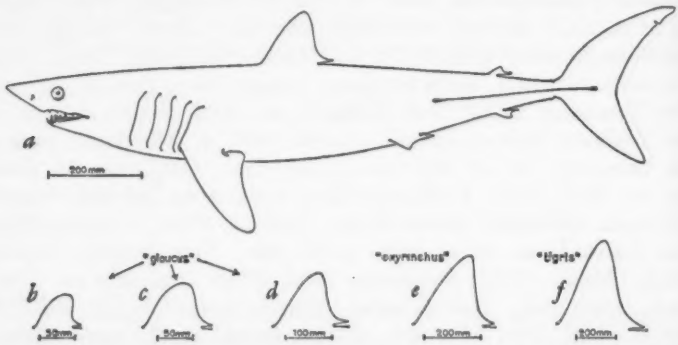

FIGURE 6.—*Isurus oxyrinchus: a*, Dom. Mus. (New Zealand) 3014, female, 1438 mm., New Zealand. First dorsal fins showing change in shape and proportions with growth: *b*, Mus. Comp. Zool. (Harvard) 37994, embryo, male, 605 mm., Bahamas; *c*, Dom. Mus. (New Zealand) 2945, female, 871 mm., New Zealand; *d*, specimen in fig. *a* above; *e*, male, 2535 mm, New Zealand; *f*, female, 3,200 mm., New Zealand (drawn from cast in Auckland Museum). (Names in quotation marks are nominal species to which the specimens previously would have been referred according to their fin shapes and proportions.)

DESCRIPTION.—For extensive descriptions of this species see Bigelow and Schroeder (1948, p. 124) and Smith (1953, p. 977; 1957, p. 94; 1958, p. 134), variously under the names *I. oxyrinchus*, *I. glaucus*, and *I. tigris*.

Table 2 gives the proportional dimensions of five specimens of *I. oxyrinchus* for comparison with those of the long-finned species. Vertebral counts and data for specimens of *I. oxyrinchus* do not show

any significant difference from those of the long-finned species but are given below for comparison:

Isurus oxyrinchus specimen	locality	number of vertebrae: precaudal[7]	caudal	total
Mus. Comp. Zool. (Harvard) 37994	Bahamas	110	80	190
Univ. Michigan Mus. Zool. 177116	Japan	108	79	187
Scripps Inst. Oceanogr. 50-240	California	112	80	192
Data from J. G. Casey on three specimens	New York-New Jersey	109–110	80–81	190–191
U.S. Nat. Mus. 197686	South Africa	111	79	190

Centra very regular along entire vertebral column. Centrum diameter much greater than centrum length even in longest monospondylous centra at posterior region of abdomen. Diplospondyly occurs over anterior third to middle of pelvic base.

$\frac{\text{Length}}{\text{Diameter}}$ of penultimate monospondylous centrum=0.46 to 0.55.

$\frac{\text{Length of penultimate monospondylous centrum}}{\text{Length of first diplospondylous centrum}}$=1.14 to 1.24.

Isurus alatus, new species[8]

Long-finned Mako

Isurus glaucus.—Strasburg (in part), 1958, p. 357. [Central Pacific.]
Isurus oxyrhynchus.—Fourmanoir (in part), 1961, p. 79. [Madagascar.]

STUDY MATERIAL.—Holotype: U.S. Nat. Mus. no. 197427, male, 1,233 mm., from the tropical Indian or Pacific Oceans, collected during 1962 by a Japanese long-liner, and supplied by T. Abe.

Paratypes: U.S. Nat. Mus. no. 197429, female, 1,372 mm., same data as holotype; U.S. Nat. Mus. no. 197435, mature male, incomplete, lacking caudal fin and first dorsal fin, 1,720 mm. long from snout tip to just in front of precaudal pits, same data as holotype.

SUPPLEMENTARY MATERIAL.—U.S. Nat. Mus. no. 196024, jaws, skin sample, photographs and measurements of male, 1,251 mm., from equatorial Pacific between 150° W. and 170° W., May 3, 1953, USFWS, Pacific Oceanic Fishery Investigations (MV *John R. Manning*, Cruise 15, Station 2); U.S. Nat. Mus. no. 196039, jaws, photographs, and measurements of male, 1,801 mm., from equatorial

[7] Precaudal centra include all complete centra anterior to a vertical through the forward margin of the upper precaudal pit.

[8] As mentioned in footnote 3, Guitart Manday (1966) has recently described this species under the name *I. paucus*, which, therefore, has priority.

Pacific between 150° W. and 160° W., Aug. 26, 1953, USFWS, Pacific Oceanic Fishery Investigations (MV *John R. Manning*, Cruise 16, Station 29); also measurements of male, 2,150 mm., from Pacific, north of Hawaiian Islands, between 22° N. and 47° N., and 159° W. and 177° W., Sept. 19, 1954, USFWS, Pacific Oceanic Fishery Investigations (MV *John R. Manning*, Cruise 22, Station 7).

DIAGNOSIS.—An *Isurus* with very long pectoral fins equal in length to head; with at least some dusky coloration on underside of snout and around mouth; and with first tooth on each side of symphysis in both jaws having a complete cutting edge (from tip of cusp to base) on its lateral as well as on its medial margin.

COMPARISON.—The very long pectoral fins of *I. alatus* readily distinguish this species from *I. oxyrinchus*. As can be seen in figure 1, the pectoral fins of *I. alatus* are equal to the head length, whereas in *I. oxyrinchus* they are not more than about 70 percent of the head length over most of the size range of specimens examined. Only in specimens of *I. oxyrinchus* of 2,400 mm. long or longer do the pectorals exceed 70 percent of the head length, and the highest value I have is 84 percent in a New Zealand specimen 2,642 mm. long.

Comparison of pectoral length as a percentage of total length relative to total length (fig.2) again indicates a clear-cut separation of *I. alatus* and *I. oxyrinchus*. However, the relative increase in pectoral length with growth in specimens of *I. oxyrinchus* of 1,200 mm. long and longer does mean that the largest adults of *I. oxyrinchus* approximate, but do not overlap, *I. alatus*. Information is desirable on larger specimens of *I. alatus* to indicate whether it shows a comparable relative increase in its pectoral length with growth. The apparent relative decrease in pectoral fin length which my data (fig. 2) show for specimens of *I. oxyrinchus* from birth size to about 1,000 mm. is, if valid, another interesting example of the variation in growth-change patterns in sharks.

As well as its longer pectoral fins, *I. alatus* has longer pelvic fins than *I. oxyrinchus* (figs. 6, 7; table 2). In *I. alatus* the anterior margin of the pelvic fin is equal to or only slightly shorter than the distal margin, whereas in *I. oxyrinchus* the anterior margin is noticeably shorter.

The dusky coloration on the underside of the snout of *I. alatus* contrasts strongly with the immaculate whiteness of this region in *I. oxyrinchus*. The duskiness increases with growth—hence the smallest specimens of *I. alatus* only have duskiness fringing the underside of the snout tip and around the mouth. In the largest specimen the duskiness is not only more extensive under the snout but is darker.

Several differences can be noted between the teeth of *I. alatus* and *I. oxyrinchus*. Those of *I. alatus* have noticeably broader cusps, are less flexuous, and less oblique (pls. 1, 2; figs. 8, 9). The first upper and lower teeth of *I. alatus* have on their lateral margins a cutting edge

which extends from the tip of the cusp to the base. The medial margins are similarly armed. The first tooth is therefore similar to the second tooth. In *I. oxyrinchus* (excepting largest adults) the first tooth in each jaw does not have a complete cutting edge on its lateral margin. It is therefore dissimilar from the second tooth, particularly in the upper jaw. The cutting edge on the lateral margin of the first tooth is present at the tip of the cusp but extends only part way to the base. The relative length of this cutting edge varies with growth. In juveniles the cutting edge may be only one-third or less of the length of the cusp, but in subadults and larger specimens it will commonly extend along two-thirds of the cusp. In large adults of 2,500 mm. or more the cutting edge approaches or reaches the base—when the distinction between *I. alatus* and *I. oxyrinchus* on this character disappears. The same can be said of tooth shape in large adults of *I. oxyrinchus* where the teeth are less flexuous and proportionately broader than those of smaller specimens—thus the teeth of large adults of *I. oxyrinchus* are like those of *I. alatus*.

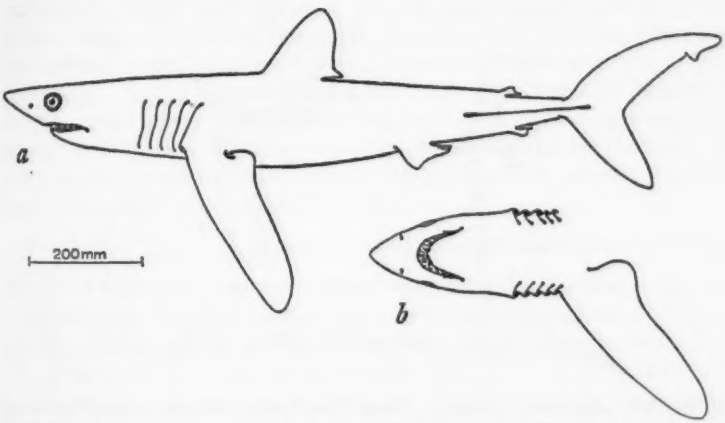

FIGURE 7.—*Isurus alatus*, new species: *a*, *b*, holotype, USNM 197427, male, 1233 mm., tropical Pacific or Indian Oceans.

Another difference between the teeth of the two species is in the position and shape of the third upper tooth. In *I. alatus* the third upper tooth is below the lateral margin of the palatine process of the palatopterygoquadrate cartilage and is only slightly oblique in shape (pl. 1). In *I. oxyrinchus* the third upper tooth is more medial in position, usually below the upper two-thirds of the lateral margin of the palatine process, and the tooth itself is more asymmetrical and oblique in shape.

The difference between the species in the shape of the tail, especially in the relative prominence of the terminal lobe of the dorsal lobe and the subterminal notch (figs. 6, 7), may not be so evident in large specimens. Usually the terminal lobe becomes smaller and less conspicuous with growth. If this is so in *I. alatus*, then adults of *I. alatus* should show a condition more like that of *I. oxyrinchus*.

The relative slenderness of *I. alatus* is difficult to evaluate because my material is in poor condition. However, my interpretation of *I. alatus* as a slender species compared with I. *oxyrinchus* is supported by Fourmanoir's data (1961, pp. 17, 79) which give the weight of a 2,180 mm. specimen, apparently *I. alatus*, as 70 kilograms, whereas two specimens of *I. oxyrinchus* of 2,580 mm. weighed 150 and 200 kilograms. Bigelow and Schroeder (1948, p. 128) give the weight of an 1,830 mm. *C. oxyrinchus* as 61 kilograms, and a 2,340 mm. specimen as 104 kilograms.

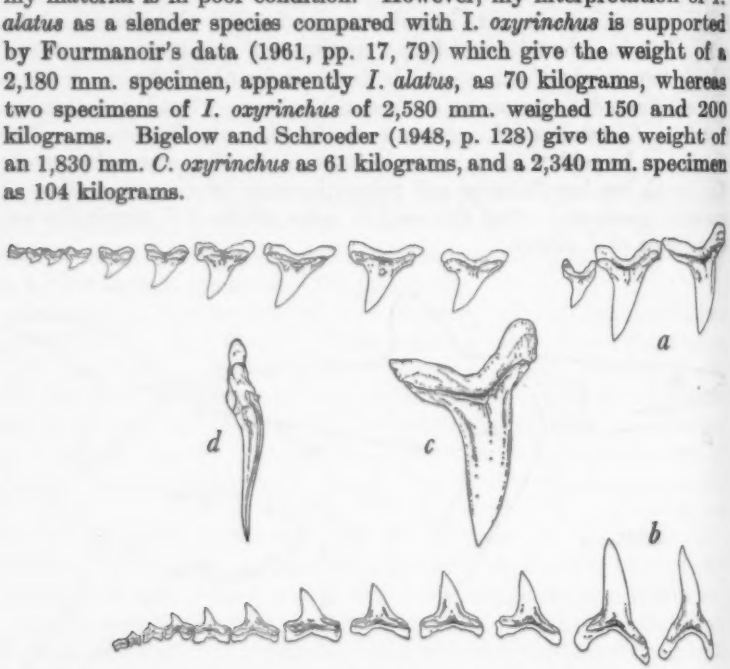

FIGURE 8.—*Isurus alatus*, new species, USNM 196039, male, 1801 mm., central Pacific: *a*, *b*, upper and lower teeth, right side; *c*, *d*, first upper tooth, right side, anterior and lateral views, showing complete cutting edge on lateral margin.

One further difference between the two species is in the size of the eye, that of *I. alatus* being slightly larger at all sizes than that of *I. oxyrinchus*.

Judging by the photographs of two central Pacific specimens (pls. 3,4), the first dorsal fin of *I. alatus* changes in shape and proportions with growth in a manner comparable to that of *I. oxyrinchus*.

DESCRIPTION.—Based mostly on the 1,233 mm. holotype and the 1,372 mm. paratype.

For proportional dimensions in percent of total length, see table 2.

Trunk slender, its height at pectoral origin about one-seventh of its length to subcaudal origin. Caudal peduncle notably flattened dorsoventrally, and expanded laterally to form a sharp-edged horizontal keel along midlevel of each side; anteriorly the keels become inconspicuous a little behind tips of pelvic fins, while posteriorly they extend onto anterior part of caudal fin. Lateral line not prominent. Upper and lower precaudal pits strongly developed, their anterior margins transverse and sharply defined.

Dermal denticles small, close packed, overlapping, circular in outline, each with three longitudinal ridges and three posterior marginal teeth, the latter relatively larger in denticles of smaller specimens, median tooth always longer than lateral teeth.

Head long, its length to fifth gill opening one-quarter of total length, its greatest width 2.2 to 2.1 in its length. Snout sharply pointed, conical, slightly depressed dorsally, its length to eye 4.2 to 4.3 in head. Prenarial length equal to internarial distance and 1.4 to 1.5 in preoral length. Eye large, circular, its diameter 2.8 to 3.1 in snout, its anterior margin slightly behind front of mouth. Nostrils almost transverse, small, their anterior margins with a low pointed lobe. Mouth large, rather long, upper lip broadly arched at front, lower lip not meeting upper even when mouth is closed; width of mouth 1.2 in its length. Labial furrows long, upper more than one-third length of mouth, lower about two-thirds as long as upper. Gill openings very large, their vertical lengths extending almost two-thirds of depth of body at same region; lower end of fifth gill opening extends beneath and slightly behind pectoral fin origin.

Teeth $\frac{12 \text{ or } 13\text{–}12 \text{ or } 13}{11 \text{ or } 12\text{–}11 \text{ or } 12}$, similar in upper and lower jaws, unicusped, narrowly triangular, smooth edged, with complete cutting edges on their lateral and medial margins; first two teeth on each side of symphysis in both jaws noticeably longer than others; those in upper jaw closely followed by a very much smaller third tooth, and the latter by a distinct gap before larger lateral teeth begin; first two upper teeth slightly oblique to curved in outline; in side view these first two upper teeth are virtually straight except for their tips which curve outward; lateral teeth oblique in outline, and progressively smaller toward angles of jaws. In lower jaw the third tooth smaller than first two teeth but at least as large as fourth, and the gap between third and fourth teeth not greater than that between fourth and fifth; first lower tooth distinctly narrower than second; first two lower teeth weakly flexuous in outline; in side view the first two lower teeth are curved inward except for their tips which are reverse curved like those of upper teeth; lateral teeth oblique and diminishing in size toward angles of jaws. Two or three rows of teeth functional at center of mouth in both jaws, one or two rows along sides.

First dorsal fin fairly large, its height 1.1 to 1.2 times its base, and 1.2 in distance from posterior margin of eye to first gill opening; length of rear tip of first dorsal 3.7 to 3.6 in first dorsal height; apex of first dorsal moderately rounded, anterior margin weakly convex, distal margin more strongly convex along its upper two-thirds but concave below; origin of first dorsal varying from well behind to almost above posterior (inner) corner of pectoral fin; rear tip of first dorsal anterior to pelvic fin origin by a distance of about 1½ times length of pelvic base. Second dorsal fin very small, short based but with a rather long rear tip; height of second dorsal 1.2 to 1.0 times its base, and one-tenth to one-ninth of height of first dorsal; length

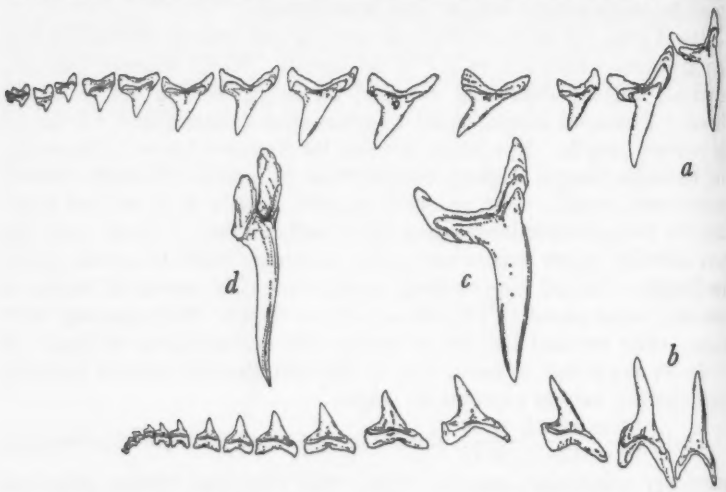

FIGURE 9.—*Isurus oxyrinchus*, Scripps Inst. Oceanogr., 54–140, Baja Calif.: *a*, *b*, upper and lower teeth, right side; *c*, *d*, first upper tooth, right side, anterior and lateral views, showing incomplete cutting edge on lateral margin. (The jaw from which these teeth were drawn is of comparable size to that of *I. alatus* in figure 8.)

of rear tip almost twice second dorsal height; origin of second dorsal well anterior to anal origin. Caudal fin somewhat lunate in outline, ventral lobe shorter than dorsal lobe, terminal lobe strongly developed; length of ventral lobe 1.5 to 1.4 in dorsal lobe; length of terminal lobe measured from tip of dorsal lobe to base of subterminal notch 4.2 to 4.4 in dorsal lobe. Anal fin similar in shape to second dorsal fin but slightly larger; origin of anal fin slightly behind or just below posterior end of second dorsal base. Pelvic fins moderately large, anterior margins equal to or a little longer than bases, and only slightly shorter than distal margins; length of pelvic base 1.7 to 1.9 in first dorsal base. Pectoral fins remarkably long, only slightly

tapered, anterior (outer) corners moderately rounded; length of anterior margin of pectoral slightly greater than head length measured from tip of snout to most anterior part of fifth gill opening; when adpressed to side of body with anterior pectoral margin horizontal, anterior (outer) pectoral corner reaches about 90 percent of distance from pectoral origin to pelvic origin.

COLOR.—Grayish black above, white below; underside of snout and around mouth at least partly dusky, more so in largest specimen; dorsal fins and both lobes of caudal fin dusky black; pectoral fin dusky black above except for a translucent to white area at posterior (inner) corner; underside of pectoral fin white but with a narrow dusky band along anterior margin, and a broader dusky-black edging to anterior (outer) corner and outer half of distal margin; pectoral fin in largest specimen, in addition, with some black mottlings underneath; pelvic fin dusky black on anterior half of upper surface, white posteriorly and below except in largest specimen in which underside is partly black mottled; anal fin in holotype white, with a dusky-black blotch anteriorly; anal fins in paratypes with more dusky-black coloration, only distal margins remaining more or less white.

VERTEBRAE.—Vertebral counts as in table 2. Centra very regular over entire length of vertebral column. Centrum diameter considerably greater than centrum length, even in longest monospondylous centra at posterior region of abdomen. Diplospondyly occurs above anterior third to middle of pelvic base.

$$\frac{\text{Length}}{\text{Diameter}} \text{ of penultimate monospondylous centrum} = 0.63 \text{ to } 0.67$$

$$\frac{\text{Length of penultimate monospondylous centrum}}{\text{Length of first diplospondylous centrum}} = 1.28 \text{ to } 1.30$$

DISCUSSION.—The specific name of *I. alatus* is the Latin adjective *alatus*=winged, and is given in reference to the extremely long pectoral fins of this species.

In view of the wide distribution of the few known specimens of *I. alatus* (central Pacific to Indian Ocean), it is rather surprising that the species has not been recognized before. The chief reason for this may be that it is a truly oceanic species, not coming inshore as does *I. oxyrinchus*. If this is the case, it is understandable that it has not been taken during routine oceanographic explorations, few of which have been equipped to catch fishes as large as isurid sharks. The comparatively recent discovery of the abundance of other oceanic sharks such as *Carcharhinus falciformis* and *C. longimanus* in the western North Atlantic is a parallel situation. The larger eyes of *I. alatus* suggest the possibility that it lives in rather deeper water than *I. oxyrinchus*.

Addendum

Accounts of the following two species have appeared since the present revision was prepared.

Isurus paucus Guitart Manday, 1966, was proposed as a new name for *Lamna punctata* of De Kay (1842) but was based on 3 adult specimens (female 2,450 mm. t.l.; male 2,030 mm., and female 2,260 mm. long from snout tip to precaudal pit) from Cuba. The measurements, description, and discussion of the Cuban specimens in Guitart Manday's account leave no doubt that his *paucus* is conspecific with my *alatus* described here on p. 677. In consequence, *alatus* becomes a junior synonym of *paucus*. Guitart Manday's proposal, however, that *paucus* is the same species as De Kay's *punctata* is open to question although whatever the answer, it will not affect nomenclature.

Lamiostoma belyaevi Glückman, 1964, was described on dental characteristics from material taken in deep water in the Pacific. Glückman (1964, p. 105) designated *belyaevi* as type species of a new genus *Lamiostoma*, which he placed in a new family, Lamiostomatidae. He diagnosed the Lamiostomatidae as having more than 3 and up to 8 functional teeth in the first series on each side of the symphysis of the jaw, whereas in his family Isuridae there are only 1 to 3 functional teeth. Glückman's illustrations of *belyaevi* (fig. 31, a photograph of the anterolateral aspect of a dried, mounted specimen; fig. 32, a photograph of the lower jaw, possibly of the same specimen as in fig. 31; and pl. 31, figs. 13, 14, 18, and 19, photographs of individual teeth) strongly suggest that he had an *Isurus* and that the high number of apparently functional teeth was due to exposure of the replacement teeth behind those normally functional (this could well be due to removal of the inner labial membrane surrounding the replacement teeth when the specimen was prepared for mounting). Figure 31 also suggests that *belyaevi* has notably long pectoral fins and is dark colored or dusky under the snout and head—features characteristic of *I. paucus*. Evaluation of the status of *belyaevi*, however, cannot proceed until more information is available, particularly on its proportional dimensions, its teeth, and its color.

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TABLE 1.—*Some proportional dimensions of short-finned* Isurus

TABLE 1.—*Some proportional dimensions of short-finned* Isurus

	A First dors. base as % t.l.	B Snout to pect. orig. as % t.l.	C Snout to first dors. orig. as % t.l.	D Pect. orig. to first dors. orig. as % t.l.	E Pect. axil to pelv. orig. as % t.l.	F Snout to pect. orig. Pect. orig. to first dors. orig.	G Snout to pect. orig. Pect. axil to pelv. orig.	H Pect. orig. to first dors. orig. Post. of eye to first gill	I Post. of eye to third gill First dors. height	J Dorsal lobe caudal Ventral lobe caudal
SPECIMENS STUDIED										
600 mm. to 1,400 mm. t.l.										
Range	8.4– 9.3	24.8–28.8	36.7–40.3	8.9–13.9	20.7–27.6	1.76–3.22	0.89–1.35	0.70–1.36	1.74–2.20	1.29–1.48
Mean	8.9	26.8	38.0	11.3	23.5	2.46	1.16	0.98	1.98	1.37
No. of specimens	10	10	10	10	9	10	10	10	9	8
1,401 mm. to 2,200 mm. t.l.										
Range	8.5– 9.0	25.8–27.1	34.7–38.4	9.4–12.7	22.9–24.8	2.04–2.83	1.03–1.17	0.79–1.27	1.60–1.83	1.19–1.40
Mean	9.0	26.1	36.9	10.8	24.1	2.45	1.09	0.99	1.68	1.29
No. of specimens	11	10	10	10	3	10	4	4	4	10
2,201 mm. to 3,200 mm. t.l.										
Range	7.7–10.3	24.0–26.0	34.8–40.5	8.3–13.0	24.1–24.5	1.85–3.20	0.77–1.10	0.85–1.30	1.30–1.67	1.20–1.41
Mean	9.0	25.4	37.6	11.0	27.5	2.41	0.94	1.04	1.51	1.30
No. of specimens	13	13	13	12	5	13	5	5	5	10
TYPES										
I. glaucus										
1,020 mm. t.l.	9.4	24.6	37.3	13.2	23.3	1.86	1.05	1.12	2.14	1.34
I. hâmi										
1,195 mm. t.l.	8.8	26.3	38.0	11.7	22.2	2.34	1.15	0.99	-	1.28
I. gompbodon										
ca. 1,700 mm. t.l.	9.5	25.2	22.4	7.0	19.6	3.60	1.28	0.69	2.05	1.41
I. capelli										
1,850 mm. t.l.	-	-	-	-	-	-	-	-	-	1.68
I. africanus										
2,540 mm. t.l.	10.0	25.1	40.2	15.3	29.6	1.64	0.84	0.82	1.48	1.21
I. tigris										
2,690 mm. t.l.	11.3	27.3	44.7	17.4	32.3	1.57	0.85	1.27	-	1.28
I. huidobrii										
2,900 mm. t.l.	8.3	28.9	37.5	8.8	23.5	3.36	1.23	-	-	-
I. dekayi										
3,100 mm. t.l.	11.5	-	35.2	-	-	-	-	-	-	1.19

TABLE 2.—*Proportional dimensions in percent of total length*

Isurus oxyrinchus	♂705 mm. California UMMZ 94726	♂847 mm. Japan MCZ 35071	♀1438 mm. New Zealand Dom. M. 3014	♀1920 mm.[1] South Africa USNM 197696	♀2000 mm. W. of Azores USNM 197706
Snout tip to					
outer nostrils	4.8	4.1	3.8	4.7	3.9
eye	7.8	6.8	6.6	6.8	6.2
mouth	6.9	5.3	5.9	6.0	5.0
1st gill opening	22.5	19.7	18.4	19.8	19.6
3rd gill opening	25.7	24.4	23.4	23.8	23.4
5th gill opening	28.1	26.2	25.7	25.4	25.3
pectoral origin	28.1	26.2	25.7	25.4	25.3
pelvic origin	55.7	57.2	57.4	57.2	55.1
1st dorsal origin	37.4	38.0	38.7	36.7	34.7
2nd dorsal origin	70.2	71.6	72.3	71.8	69.2
anal fin origin	71.2	72.4	72.8	72.4	70.8
upper caudal origin	80.1	81.8	83.2	81.6	79.2
lower caudal origin	79.7	81.8	83.3	81.8	79.1
Nostrils					
distance between inner corners	4.0	3.7	3.5	3.4	3.4
Mouth					
width	7.1	7.0	7.7	6.5	6.5
length	7.1	6.5	6.5	6.5	5.8
Gill-opening lengths					
1st	8.2	7.4	8.1	7.3	7.4
3rd	7.7	6.7	7.8	7.1	7.0
5th	7.9	7.1	7.5	7.3	7.5
Eye					
horizontal diameter	2.6	2.2	1.9	1.6	1.5
1st dorsal fin					
length of base	9.2	8.9	8.5	9.9	9.1
posterior margin	1.7	1.8	2.2	1.9	2.1
height	7.9	7.3	8.1	10.2	9.9
2nd dorsal fin					
length of base	1.1	1.2	1.1	1.2	1.0
posterior margin	2.1	2.2	2.2	2.2	2.2
height	1.4	1.2	1.1	1.3	1.2
Anal fin					
length of base	1.3	1.2	1.2	1.3	1.2
posterior margin	2.3	2.4	2.1	2.3	2.2
height	1.6	1.3	1.2	1.5	1.5
Pectoral fin					
length of base	6.9	6.7	6.7	7.2	6.9
anterior margin	18.4	17.0	16.4	17.4	17.6
distal margin	13.7	13.4	14.8	14.8	14.6
Pelvic fin					
length of base	5.8	4.7	5.3	5.9	5.6
anterior margin	5.0	4.5	3.8	4.5	4.3
distal margin	5.7	5.3	5.8	6.0	6.0
length of claspers	3.0	2.6	—	—	—

See footnotes at end of table.

TABLE 2.—*Proportional dimensions in percent of total length*—Continued

Isurus oxyrinchus	♂705 mm. California UMMZ 94726	♂847 mm. Japan MCZ 35071	♀1428 mm. New Zealand Dom. M. 3014	♀1920 mm.[1] South Africa USNM 197686	♀2000 mm. W. of Azores USNM 197706
Caudal fin					
length dorsal lobe	21.8	19.6	20.5	20.6	20.8
length ventral lobe	15.7	14.9	16.0	16.1	17.6
Trunk at pectoral origin					
width	12.9	11.0	12.5	—	11.0
height	15.3	13.0	12.9	—	11.6
Dental formula	13–13 / 13–13	—	13–13 / 15–15	—	13–13 / 12–12
Total vertebrae	—	—	—	190	—
Precaudal vertebrae	—	—	—	111	—
Caudal vertebrae	—	—	—	79	—

Isurus alatus, new species	♂1233 mm. Indo-Pacific USNM 197427	♂1251 mm.[2] Central Pacific USNM 196024	♀1372 mm. Indo-Pacific USNM 197429	♂1801 mm.[3] Central Pacific USNM 196039	♂2150 mm.[3] Central Pacific
Snout tip to					
outer nostrils	4.3	5.4	4.4	5.1	5.0
eye	6.1	—	6.0	—	—
mouth	6.2	7.2	6.4	6.8	6.7
1st gill opening	19.7	—	19.7	—	—
3rd gill opening	23.1	—	23.6	—	—
5th gill opening	25.4	—	25.5	—	—
pectoral origin	25.4	25.6	25.5	23.5	24.9
pelvic origin	55.1	55.3	55.7	53.9	56.6
1st dorsal origin	36.5	38.2	37.2	36.9	38.6
2nd dorsal origin	69.4	70.3	68.9	70.2	71.3
anal fin origin	70.7	—	69.6	—	—
upper caudal origin	78.7	77.9	78.8	79.5	79.9
lower caudal origin	78.3	—	78.6	—	—
Nostrils					
distance between inner corners	4.5	4.6	4.3	4.3	4.1
Mouth					
width	7.9	7.9	7.4	7.9	6.8
length	6.4	5.4	6.2	6.0	6.1
Gill-opening lengths					
1st	7.9	7.1	6.7	7.6	6.5
3rd	7.4	7.5	6.6	7.2	6.3
5th	7.0	7.3	7.3	7.3	7.3
Eye					
horizontal diameter	2.2	2.0	2.1	2.1	1.9
1st dorsal fin					
length of base	8.6	8.8	8.0	8.2	8.7
posterior margin	2.6	—	2.8	—	—
height	9.6	9.4	9.9	9.7	10.0

See footnotes at end of table.

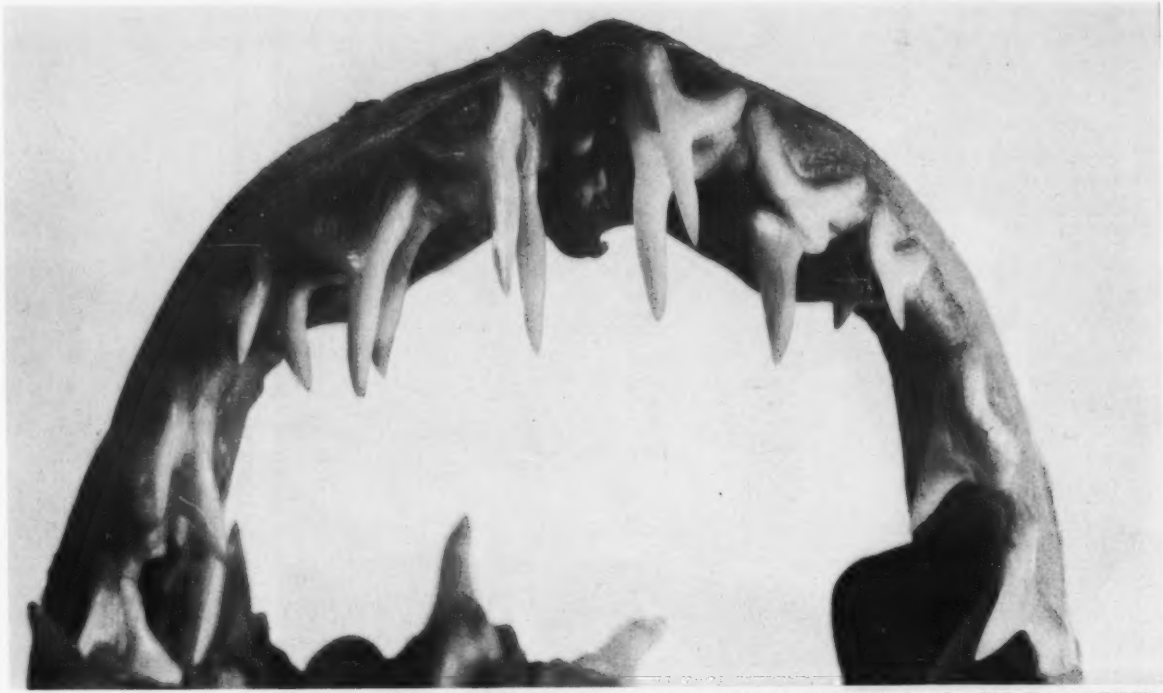
TABLE 2.—*Proportional dimensions in percent of total length*—Continued

Ixurus alatus, new species	♂[1]233 mm. Indo-Pacific USNM 197427	♂[1]251 mm.[2] Central Pacific USNM 196024	♀372 mm. Indo-Pacific USNM 197429	♂[1]801 mm.[2] Central Pacific USNM 196039	♂[1]?[1]59 mm.[2] Central Pacific
2nd dorsal fin					
length of base	1.0	1.0	0.9	0.8	0.8
posterior margin	1.9	—	1.7	—	—
height	1.1	1.1	1.0	0.9	0.9
Anal fin					
length of base	1.1	—	1.2	—	—
posterior margin	1.9	—	2.0	—	—
height	1.3	—	1.2	—	—
Pectoral fin					
length of base	6.3	—	6.0	—	—
anterior margin	26.4	25.1	26.5	24.4	25.0
distal margin	23.3	—	23.7	—	—
Pelvic fin					
length of base	4.9	—	5.1	—	—
anterior margin	5.4	—	5.2	—	—
distal margin	5.4	—	5.7	—	—
length of claspers	2.8	—	—	—	—
Caudal fin					
length dorsal lobe	22.0	22.1	22.0	20.5	20.1
length ventral lobe	15.0	15.9	15.5	16.8	15.2
Trunk at pectoral origin					
width	10.5	12.5	10.6	11.2	10.9
height	11.0	12.5	—	13.2	11.8
Dental formula	13–12 / 12–12	13–12 / 11–12	12–12 / 11–11	13–13 / 12–12	—
Total vertebrae	195	—	197	—	—
Precaudal vertebrae	112	—	111	—	—
Caudal vertebrae	83	—	86	—	—

[1] Only the jaws of this specimen were preserved.

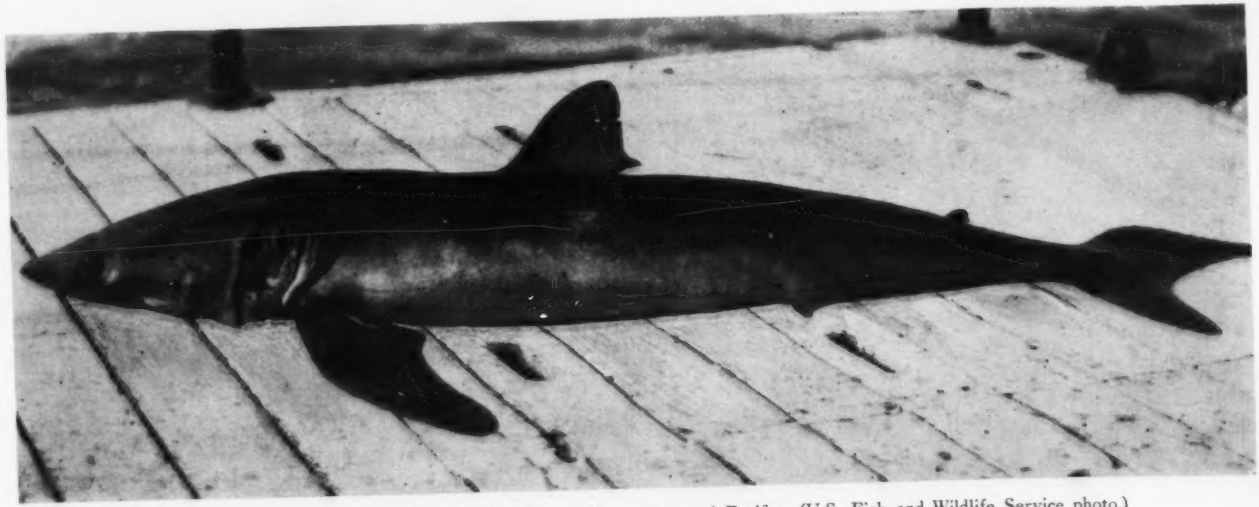
[2] Measurements supplied by Dr. Donald W. Strasburg. Only the jaws of these specimens were preserved.

Isurus alatus, new species, USNM 196039, male, 1801 mm., central Pacific, upper jaw. (U.S. Fish and Wildlife Service photo.)



Isurus oxyrinchus, Scripps Inst. Oceanogr. 54–140, Baja California, upper jaw of comparable size to that in plate 1. (U.S. Fish and Wildlife Service photo.)

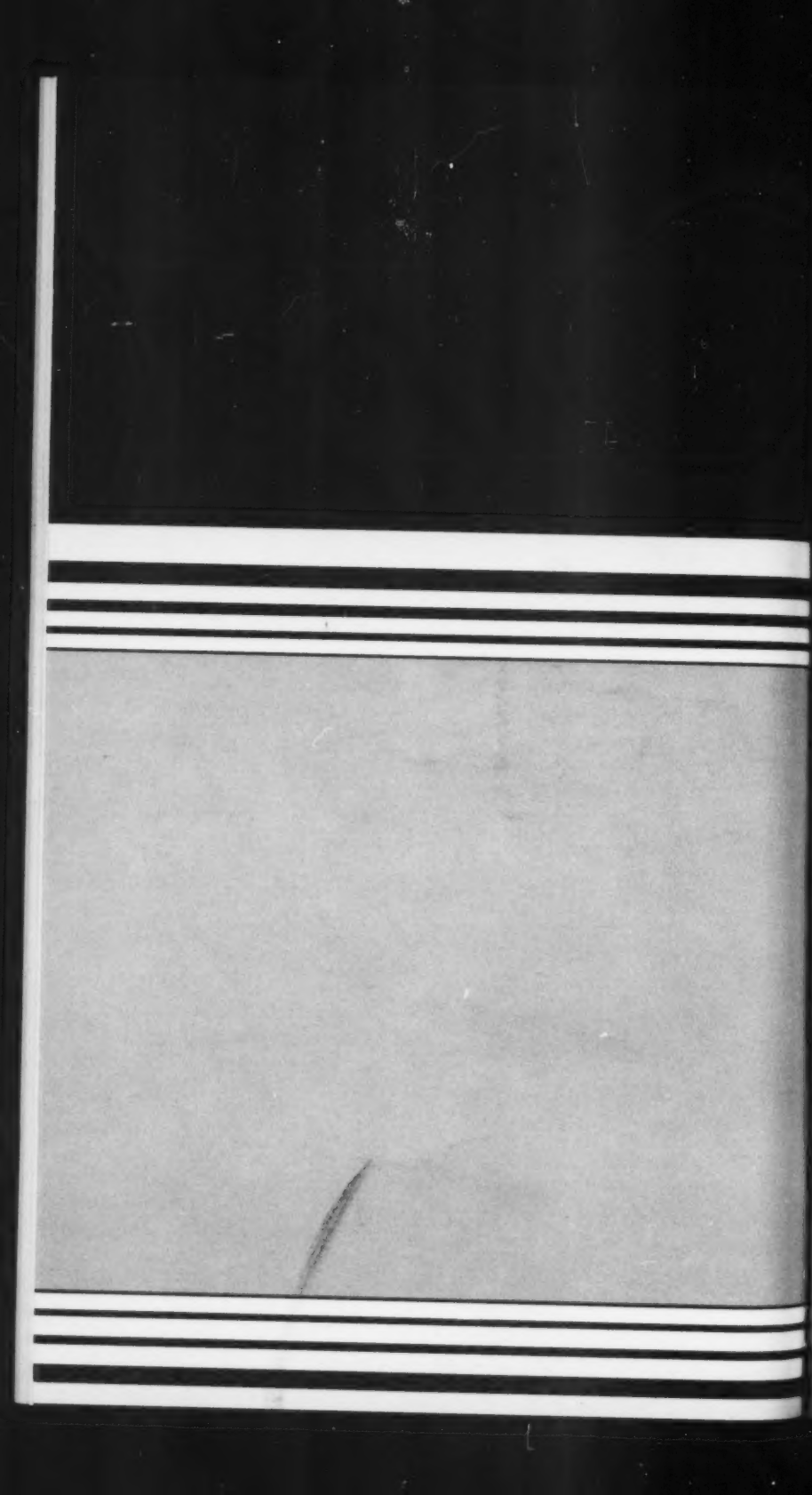
Isurus oxyrinchus, Scripps Inst. Oceanogr. 54–140, Baja California, upper jaw of comparable size to that in plate 1. (U.S. Fish and Wildlife Service photo.)



Isurus alatus, new species, USNM 196024, male, 1251 mm., central Pacific. (U.S. Fish and Wildlife Service photo.)

Ixurus alatus, new species, USNM 196039, male, 1801 mm., central Pacific: top, first dorsal fin; bottom, caudal peduncle from above. (U.S. Fish and Wildlife Service photo.)

Isurus alatus, new species, USNM 196039, male, 1801 mm., central Pacific: top, first dorsal fin; bottom, caudal peduncle from above. (U.S. Fish and Wildlife Service photo.)



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